WORK

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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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WORK WORLD.

THE Dunlop pneumatic tire has been further improved by the introduction of a pad of cork $\frac{1}{8}$ in. thick. Its object is to prevent the inner rubber tube from chafing or cutting at the edges of the steel rim.

* *

An improved tool-heating gas burner has been invented. It consists of a burner somewhat similar to the ordinary kind. To it is attached a lever which works a weight inside the burner. When the tool is placed on the burner it turns the gas full on, and when taken off the weight drops and checks the supply of gas. This should go.

* *

A new photographic dry-plate will shortly be introduced, which will probably cause some stir among photographers generally, and particularly among those whose speciality is the photographing of interiors. It is claimed for it that it is the only plate that renders photography in natural tones a possibility, that halation is annihilated, and that with it the loss of a negative from over-exposure is practically a thing of the past. We wish it every success.

* *

The New Geared Ordinary bicycle takes its name from having its larger wheel in front. This serves for the driving and steering wheel like an ordinary, as distinguished from a "safety," which has the steering wheel in front and the driving wheel behind. By its gear being attached to the hub of the driving wheel, a small wheel, say 36 in., may be geared up equal to a 50 in. or 60 in., or any intermediate size. This form of machine is capable of a speed equal to the best "safety."

* *

Four-wheel carriages, however old, when sold to a user, are taxed £2 2s. a year if with pole fittings on, £1 1s. a year without such fittings. Buyer or maker arranges this payment; usually the buyer pays, but then naturally gives so much less for a vehicle. Two-wheelers pay 15s. a year; all have to pay if not used for trade solely, or for going to church exclusively. By arrangement with the authorities recently, a half-year may be paid for when used a day or two perhaps only in the half-year. The trade of coach-making has been declining for many years, especially in its foreign exports, so that this obnoxious tax should be removed from a home industry to aid it in recovering its healthy vigour as of old. Or, shall this industry, like many others, be driven out of the country?

* *

The Portuguese are considering the comparative merits of the British and French methods of constructing cables. They want a cable to the Azores and North America, and gave a contract for it to a British company. Owing to pressure from the French Government, this contract was withdrawn so as to consider the plans of a French syndicate. Two most prominent experts have sent in separate reports, and a specially appointed committee have also reported. All agree in recommending the adoption of the British plan. This is the more remarkable as, owing to African affairs, the British are not considered favourably just now by the Portuguese.

* *

A non-conducting coat for steam pipes consists of a mixture of sawdust with common starch, used in a state of thick paste. If the surfaces to be covered are well cleaned from all traces of grease, the adherence of the paste is said to be perfect for either cast or wrought iron; and a thickness of 1 in. will produce the same effect as that of the most costly non-conductors. For copper pipes there should be used a priming coat or two of potter's clay, mixed with water and laid on with a brush. The sawdust is sifted to remove too large pieces, and mixed with very thin starch. A mixture of two-thirds of wheat starch with one-third of rye starch is the best for this purpose. It is the common practice to wind string spirally around these pipes, the spirals $\frac{1}{2}$ in. apart, to secure adhesion for the first coat, which is about $\frac{1}{5}$ in. thick. When this is all dry, two or three coats of coal tar applied with a brush protect it from the weather.

* *

Information concerning the manufacture of plate-glass in Germany is very carefully guarded by a syndicate of makers, who restrict the quantity produced to certain limits. Nevertheless, some description of the process has been obtained. After leaving the glass-blowers' hands the plates, which are rough, are fixed with plaster-of-Paris on marble or cast-iron beds to be ground; the bed and the upper grinding plate revolve in opposite directions. The grinding is commenced with coarse sand, subsequently replaced by finer qualities, the process occupying from sixteen to twenty-four hours. The plates are next polished to make them transparent. The beds are stationary during this operation, in which square rubbers covered with felt are employed with a ferruginous earth called "potte," which is found in Bavaria. Glass is bevelled by holding it against a slowly revolving iron or stone cylinder 12 in. to 15 in. diameter, and fed with moistened sand. The bevels are polished on felt cylinders.

* *

There has been recently patented an improved system of davit, which will enable ships' boats to be launched outboard, and brought inboard again with the greatest ease, no matter how heavy the seas may be. The davits are so placed on the ship's deck that they take the boat from 3 ft. to 4 ft. from the side of the ship, which will minimise the risk of the boat being dashed against the ship's side. The device consists of two davits placed on the ship's deck in a line with the keel of the boat, and a little farther apart than the length of the boat; and their height is sufficient to accommodate two boats, one above the other, and lowered derrickwise from the ship outboard. Their lower ends are carried in a trunnion piece, the journals of which work in strong bearings secured to the ship's deck, their upper ends having a short bend just sufficient to reach over the stem and stern-posts to the lifting hooks in the boat; the bends retain the same position when in action. A little behind each actuating davit is a strong upright stanchion secured to the ship's deck, and further stiffened by stays. The davit is worked by ordinary tackle falls attached to the upper end of each, and likewise to the upper end of each separate stanchion. When the boat is put overboard, it is lowered down into the water in the ordinary way; when inboard, the lower boat rests on chocks on the deck, and the upper boat hangs clear above in the tackles from the davit arms, and is secured by a lashing spar. When the upper boat is lowered and detached, the davits return to their upright position, and lift out the lower boat.

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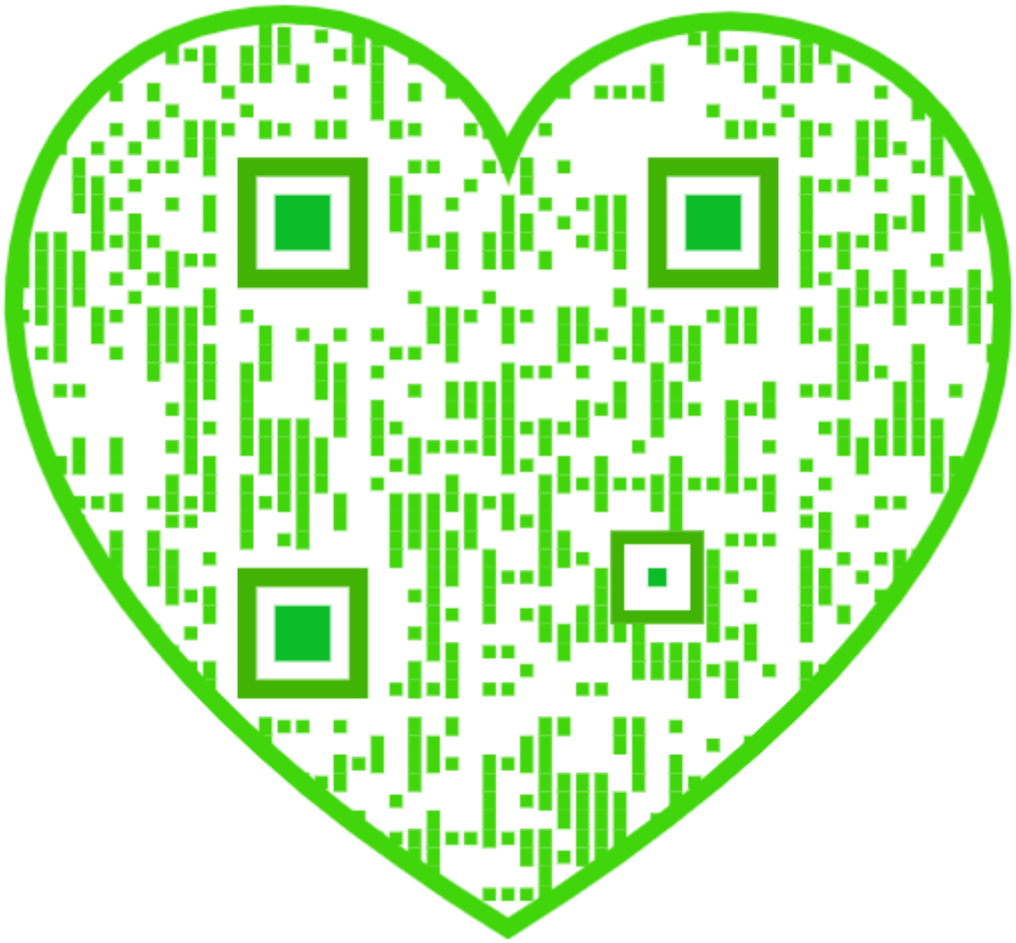

WRINKLES FOR ALL.

REPAIRERS of clockwork and similar light mechanism should not punch up worn holes to reduce them; the holes should be broached out and new bushes put in, and thus a longer rather than a shorter bearing than before will be obtained. Punching up the hole necessarily thins the plate, reducing the length of bearing, and leading to cutting into the pivot working in it; this causes extra trouble in making subsequent repairs.

BRASS may be coloured a deep blue by immersion for three or four minutes in a solution made as follows:—Dissolve $3\frac{1}{2}$ oz. of carbonate of copper in 26 oz. of liquid ammonia, and add 14 oz. of distilled water. The solution must be kept in a vessel closed air-tight; if it becomes weak by keeping, it can be recuperated by adding ammonia. The articles after immersion may be dried in sawdust.

SOMETIMES tools, plunged when hot into cold water, will not harden properly, and this may be due to the tendency of the water to form a coating of vapour which adheres to the hot metal and, keeping the water off it, prevents its quickly cooling. If the tool be plunged into mercury, it will be cooled and hardened at once, because the mercury is a good conductor of heat, and its density will prevent the vapour coating from forming. For small tools this is a convenient method of hardening, and as it leaves the hardened metal bright, it can have its temper lowered to any colour without repolishing first.

WHEN it is required to divide a circle on a metal plate into an indivisible number of parts—such as twenty-three, for instance—this cannot be done in the lathe, and in working by hand the dividers slip. To get over this difficulty, mark a circle the size of that to be divided on thin paper, divide it in the usual way by trial, with spring dividers, then cut it out and gum it on the metal; its divisions can then be marked by centre-punch or graver on the metal. This marking is to be done while the gum is damp, for as it dries the contraction of the paper will probably split it off the metal. The same method answers for dividing straight and other lines.

PHOSPHORESCENT paper may be prepared in the following manner:—Thoroughly mix, in their dry state, 4 parts of bichromate of potass, 45 parts of gelatine, and 50 parts of sulphide of calcium. Mix the resulting powder with hot water until it becomes a thick paste, when it may be used to coat paper or cardboard, which after several coatings becomes phosphorescent.

To mend a puncture in a pneumatic tire, drop a few drops of naphtha into the hole, and saturate a piece of pure rubber, a little larger than the hole, with naphtha, force it into the hole, and tie a bandage over it. Then the tire may be inflated, and the journey continued.

WHEN the hour hand of a watch gives trouble by catching on the minute hand or second hand, through having too much end-shake—a troublesome defect in hunting watches—it may be kept in place by putting around the pipe of the hour hand and beneath the dial a saucer-shaped spring of jewellers' foil. This foil may be obtained from any material shop, a ring the right size punched out, and the edge rubbed up to form the spring.

POWER HAMMERS.

BY FRANCIS CAMPIN, C.E.

SINGLE-ACTING NASMYTH STEAM HAMMER—DOUBLE-ACTING STEAM HAMMER—BLADE-SPRING MECHANICAL HAMMER—DIFFERENTIAL CYLINDER PNEUMATIC HAMMER—SINGLE CYLINDER PNEUMATIC HAMMER.

THE steam hammer, although largely used in works in which considerable masses of metal are dealt with, is not of such wide application to purposes of smaller magnitude as to render its adoption sufficiently universal to make it a commonly familiar object; and as several correspondents have evinced a general interest in the subject, I purpose in the present article to give an account of its mode of action, and that of some other power hammers which have come into use during the past few years.

There is not space for anything like a complete detailed description of the various forms of steam and other power hammers, and therefore each kind will be described in reference to a typical illustrative diagram.

Steam hammers may be broadly divided into two classes: First, those that act in their downstroke by weight alone; and second, those in which the weight is aided by steam pressure. The effect of a blow is not practically calculable, and we can only judge from previous experience what work a proposed hammer may be likely to do, and by making the hammer of the second class the advantage is obtained of being able to augment the force of the blow by increasing the pressure of the steam.

Fig. 2.

Fig. 3.

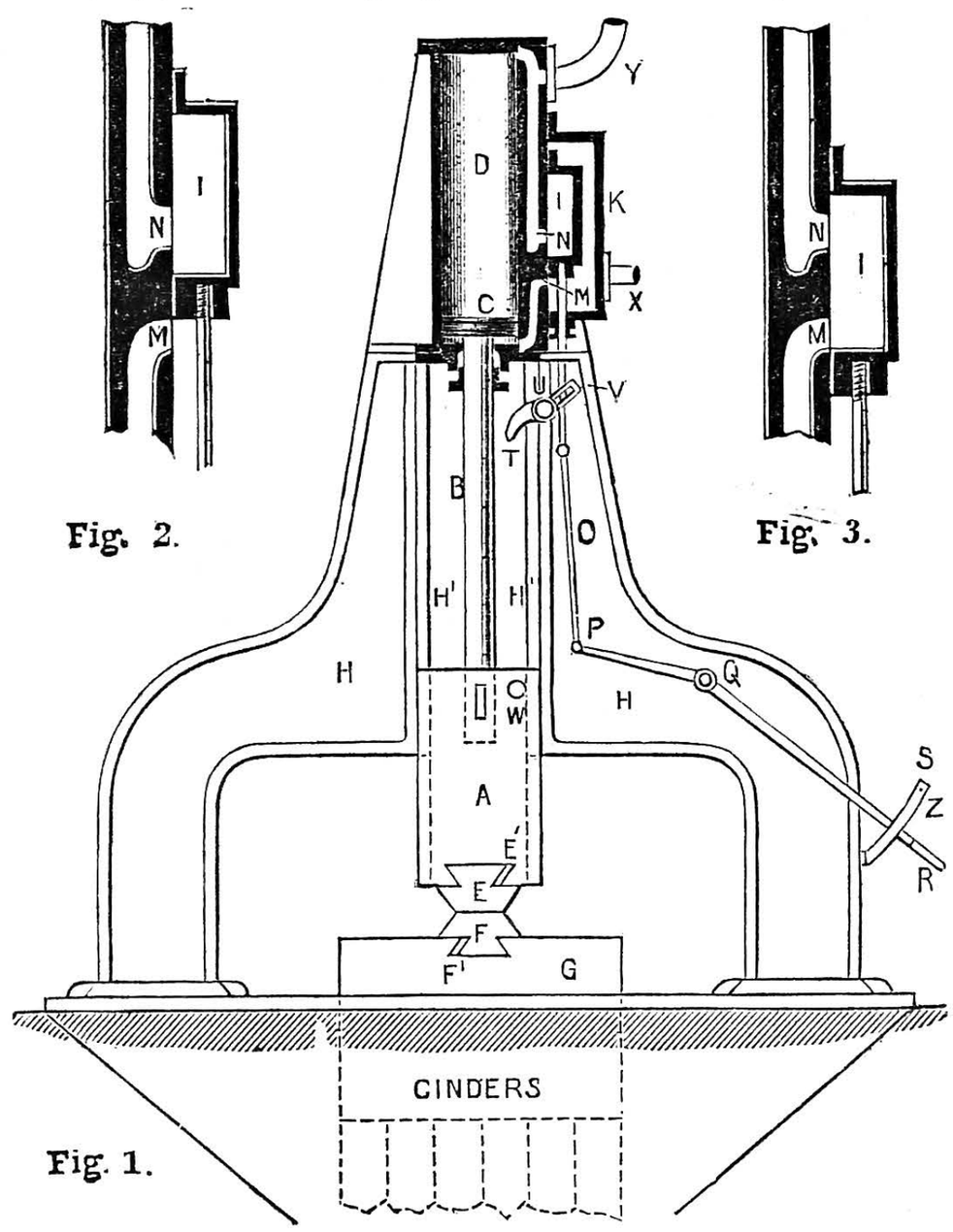

Fig. 1.

Fig. 1.—Vertical Section of Single-Acting Nasmyth Steam Hammer. Fig. 2.—Position of Slide-Valve during Upstroke. Fig. 3.—Position of Slide-Valve during Downstroke.

In Fig. 1 is shown a diagram of a single-acting steam hammer of the Nasmyth type. In this a heavy hammer-head, A, is secured by a cotter to a piston-rod, B. This piston-rod is fixed in a piston, C, which works in a vertical cylinder, D, secured to and carried by standards, H. H. Upon the faces of the standards are ribs or feathers, H^1, H^1, which form guides for the hammer-head, A, which is made with grooves (indicated by dotted lines) which fit on the guides, H^1, H^1. The hammer-face, E, which is made of steel, with a hard surface at the bottom, is fitted into the hammer-head, A, by a dovetail, which is put in the position shown and secured by a steel key, E^1. A similar face is secured to the hammer-block, G, by a key, F^1. The anvil block requires to be very massive to resist by its inertia the blow of the hammer-head, besides being soundly bedded, if necessary, on piles in beaten ashes or some similar material which will deaden vibration; for it is obvious that the effect of the blow of the hammer will depend very materially upon the resistance offered by the anvil. Steam from the boiler is admitted through a pipe, X, to the valve-jacket, K, and its admission thence to the cylinder, D, is by a port, M, controlled by a slide-valve, I. This slide-valve has a rod passing through a stuffing-box, and connected by a pin to a rod, O, by which it is operated either automatically or by a hand-lever, R, working on a dead centre at Q, and connected to rod, O, by a pin, P. A port, N, communicates with the exhaust-pipe, Y. The slide, I, is of the ordinary box form used in short-stroke engines, and by moving it the cylinder port, M, is made to communicate alternately with the boiler and with the exhaust. When the valve is in its highest position (as shown in Fig. 2) the underside of the piston is in communication with the valve-jacket, K, and the hammer is making its upstroke; and when the valve is in its lower position (as shown in Fig. 3) the steam exhausts into the atmosphere and the hammer falls. The top of the cylinder is always open to the atmosphere, to allow the piston, C, freedom of action in accordance with the distribution of steam. The handle, R, by which the movements of the machine are regulated, is guided by a segment-guard, S, between the arms of which it moves, and in which it may be secured by a pin, Z, to prevent the machine from being accidentally started. To prevent the piston from being carried too high by the action of the steam, a tappet is placed upon a pin or dead centre, U, and its outer end, V, is connected with the valve-rod; its inner end, T, is made of a suitable form to be operated by a pin, W, on the hammer-head, so as to shut off the steam as the piston approaches the upper end of its stroke. By applying a tappet, to be acted at the lower end of the stroke, the hammer is made automatic, and will, when set in action, make a number of blows in succession, until disengaged from the automatic gear. It will be seen that this machine can be handled with the greatest nicety by means of the controlling handle. The blow can be arrested at any point by re-admitting steam below the piston. As a matter of fact, a nut can be cracked without injuring the kernel by the heaviest hammers constructed on this principle.

A small alteration in the construction

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will make the hammer double-acting. In this case the steam cylinder is closed at both ends, and the steam passages connected with it are arranged as shown in Fig. 4. A short valve, C, is placed on the cylinder port-faces in a steam-chest, A, and works over the ends of passages, B and T, which lead to the bottom and top of the cylinder respectively. An exhaust-port, N, leads to the exhaust-pipe, E, and a pipe, S, from the boiler keeps the jacket, A, supplied with steam. The valve is actuated in a similar manner to that previously described, through a rod, D. Its top and bottom positions are shown by dotted and full lines respectively; in an intermediate position the margins of the valve will close both top and bottom ports, and the piston will then be held in any desired position. This valve can, of course, be worked by hand or automatically, the same as that for the single-acting hammer. Although I have here described slide-valves as used to regulate the distribution of steam, other forms may be used if desired; but it is unnecessary here to dilate upon them.

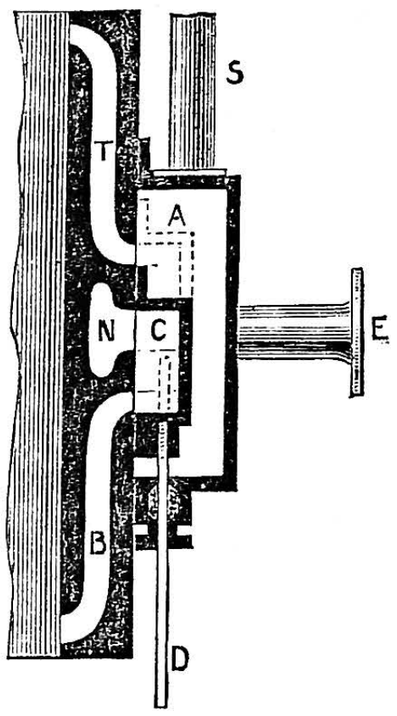

Fig. 4.—Vertical Section of Slide-Valve, Steam-Chest, Passages, and Ports for a Double-acting Nasmyth Steam Hammer.

The power is greatly augmented by making the machine double-acting, and thereby dead weight is saved, and also time; for the speed of the hammer-head will be accelerated by the steam pressure behind it, the amount of the acceleration varying as the square root of the steam pressure. Assume that for a given stroke we have a hammer-head weighing 500 lbs. in one hammer, and in another a head weighing 1,000 lbs. The blow given by the latter will be twice that of the former, but the velocities of fall will be the same in both cases, because the mass of matter is increased in the same proportion as the gravitative force; but if a pressure of 500 lbs. is caused to act upon the lighter hammer-head, its velocity of fall will be increased, for a double quantity of work will be accumulated during the stroke in the same quantity of matter, and as its mass has not increased, its velocity must have done so.

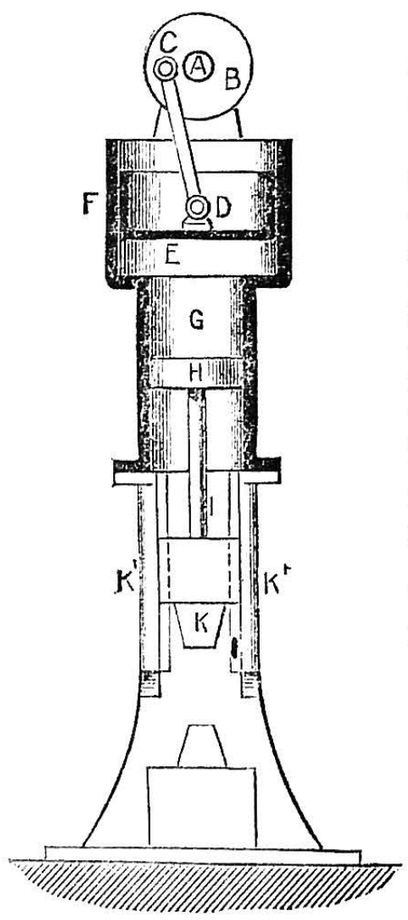

Fig. 6.—Vertical Section of Pneumatic Hammer with Differential Cylinders: Crank-driven.

If it is assumed that a hammer has a head weighing 800 lbs., and that its piston is 10 in. in diameter, the moderate pressure of 60 lbs. per square inch behind it will increase the force about six times, putting an additional pressure of 4,712 lbs. upon it. In hammers of this description it is convenient to make the piston-rods hollow and of large diameter; for only a small portion of steam is required to lift the hammer-head compared to that required to fill the cylinder, and therefore the annulus around the piston-rod may be made as small as is consistent with the convenience of packing the gland through which the piston-rod must pass.

I will now refer briefly to another form of steam hammer, that was first brought out some time after Nasmyth's hammer, and is known as the Condy type. In this arrangement the piston and its rod are fixed and the cylinder moves up and down, and forms, in fact, the hammer-head, the object being to utilise the necessary weight of the cylinder instead of obtaining the whole weight of the head from additional metal. The steam passages in this case must pass through the piston-rod to ports in the piston; the cylinder works between guides: the same as the head in the previous cases. The objection to this construction of steam hammer is that the cylinder is subject to severe shocks, and therefore, if the casting of which it consists is in any way imperfect, its failure will be rapidly brought about; whereas in the hammer with the cylinder fixed there is no shock on the cylinder, and therefore it is likely to be more durable. It is, moreover, more easy of access than is the moving cylinder.

There are many manufacturing operations concerned in the production of comparatively light articles for which separate steam hammers are not suitable, being of too expensive a character for the nature of the work, besides requiring a special attendant. Under these circumstances, various light power hammers, which may be driven from ordinary running shafts, have been put before the public. The object aimed at in the construction of these machines is to produce a hammer that will strike a comparatively light blow with great rapidity, and be all the time under instantaneous control.

One form of light power hammer is shown at Fig. 5. It is, of course, absolutely necessary that the connection between the driving-shaft and the hammer should be elastic, as the stroke of a hammer can never be a fixed quantity, depending as it must upon the extent to which the material struck will yield. In the form shown this elastic connection is supplied by a pair of blade-springs, E, E¹, similar in construction to the bearing-springs of carriages. Fast and loose pulleys are mounted on a driving-shaft, A, and they are connected with a pulley on an ordinary running-shaft by a strap, which can be shifted backwards and forwards on the said pulleys by means of the usual forked shipping-bar, so as to start and stop the hammer at will. On the shaft, A, is fixed a crank or crank disc, B, which, by a link, C D, is connected with the top blade-spring, E; the lower spring, E¹, is secured to an upwardly extending part of the hammer-head, F, which works between guides, F¹, F¹. This hammer will strike a blow harder than that due merely to its own weight, and the intensity of the blow will increase with the speed at which it is driven. During the upstroke a certain momentum is imparted to the hammer-head which, at the instant of the crank-pin reaching the top centre, will cause the springs, E, E¹, to be pressed together; and as the descent of the crank will be far more rapid than the natural fall of the hammer-head, the springs will be further compressed, and by their elasticity urge the hammer-head at a high velocity. This is a very simple form of power hammer for light purposes, and if the springs are made properly and of good material, should be very durable.

Several pneumatic power hammers have also been designed, and very good results have been given by them. The advantage of using an air spring instead of a metal one consists, probably, in its greater sensitiveness, and in the absolute uniformity of its action. One of the earlier forms of light pneumatic hammer, intended for planishing and similar purposes, is shown in Fig. 6. A casting is made, which forms two cylinders, F and G, the former being of considerably larger diameter than the latter. These cylinders are bored out and fitted with pistons, E and H. These pistons may, for small sizes, be made to fit their cylinders with sufficient truth to obviate the necessity of packing-rings: a very important matter when we come to consider the greater friction caused by such appurtenances. If the upper piston is raised, it is evident the lower one will follow it when the air above is sufficiently rarefied to give the required excess of atmospheric pressure below the piston, H, to lift its weight and that of the hammer-head, K, connected to it by a rod, I. The head, K, works in guides, K¹, K¹. On the descent of piston E, piston H will be accelerated in its fall by the compression of the air between the pistons. The piston, E, is connected by a link, C D, to the crank-pin, C, of a crank-disc, B, keyed upon a driving-shaft, A. The crank-disc will only require a small throw, as the stroke of piston E will be less than that of piston H in the ratio of the squares of the diameters of cylinders, G and F. As the crank-pin turns the top centre the piston, H, will continue to rise, and so compress the air between the pistons, which will be further compressed by the downstroke of

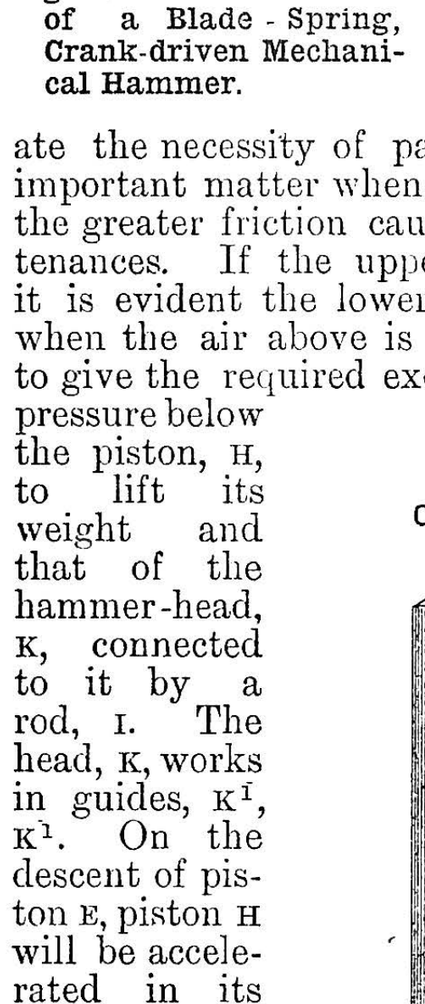

Fig. 5.—Front Elevation of a Blade-Spring, Crank-driven Mechanical Hammer.

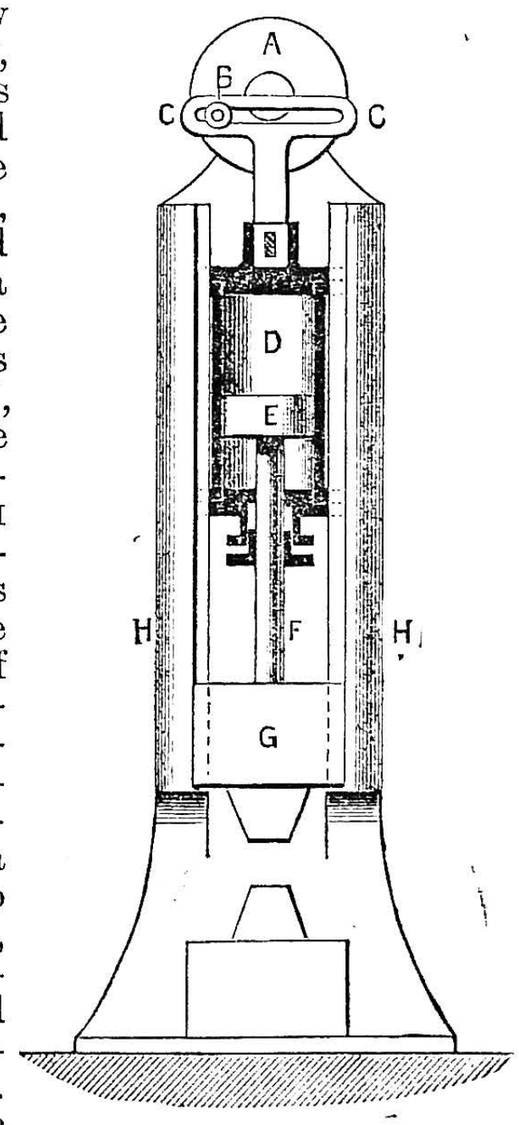

Fig. 7.—Vertical Section of Single Cylinder Pneumatic Hammer: Crank-driven.

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piston, E, and thus will impart an increased impetus to the piston, H, and hammer-head, K.

An exceedingly useful form of pneumatic hammer, capable of working at a very high speed, has a cylinder, D (Fig. 7), placed between guides, H, H, and moved vertically by a crank-disc, A, keyed on the driving-shaft. The crank-pin, B, may be connected to the cylinder either by a link or by a transverse slot (as shown at C C). This slot allows for the lateral movement of the crank-pin while receiving vertical motion from it. Between the same guides, H, H, is also placed a hammer-head, G, connected by a piston-rod, F, with a piston, E, working in the cylinder, D. If the cylinder, D, is closed at both ends, then, when it is vertically moved by the rotation of the crank-disc, A, the piston, E, and hammer-head, G, will follow its movements; their motion, however, being modified by the action of the air-cushions above and below piston E, the effect of which will be to add to the intensity of the blow. Hammers on this principle, with heads weighing about half a hundredweight, are very convenient for light work. The cylinder, D, may be fitted with valves, operated by a hand-lever or by a treadle, by opening which the cylinder is allowed to run without moving the hammer-head, thus affording means of stopping the hammer instantaneously without having to stop the cylinder and driving-shaft. From eighty to one hundred blows a minute can easily be made by these pneumatic hammers, the resilience of the air-cushions entirely obviating the evil effects of concussion.

Before closing these remarks it seems desirable to refer to a very powerful rival to the steam hammer, and one which is certainly gaining ground, and that is the hydraulic press in various forms. Although, as stated in the commencement of this article, we cannot calculate the effect of a blow, yet the work expended upon it can easily be ascertained, as we merely have to multiply the weight of the hammer (together with pressure behind it, if any) by its fall to get its value. The work done by a hydraulic press can also be ascertained by multiplying the pressure upon the ram by the distance through which it passes. By producing equal results by a hammer and by a press, the comparative cost of working can therefore be ascertained. Some months since some experiments were made on this subject by Prof. Coleman Sellars, in which he used pig-lead, the resistance of which had been shown by previous experiments to be about equal to that of steel at a bright yellow heat, which is about the highest temperature at which it can be wrought satisfactorily. I have not space here for any details of the experiments, but may sum them up by saying that a given result was produced by the hydraulic press at a little more than one-fourth of the expenditure of work required to give the same result under the hammer. Allowing that the hydraulic machinery will be somewhat more expensive than a steam hammer, and also that steam power is necessary to supply it with water-pressure, there will yet be a wide margin in favour of the press should these experiments be confirmed by practice in connection with the actual working of hot metals.

A CEMENT to resist both heat and acid can be made with quicklime and linseed-oil mixed stiffly.

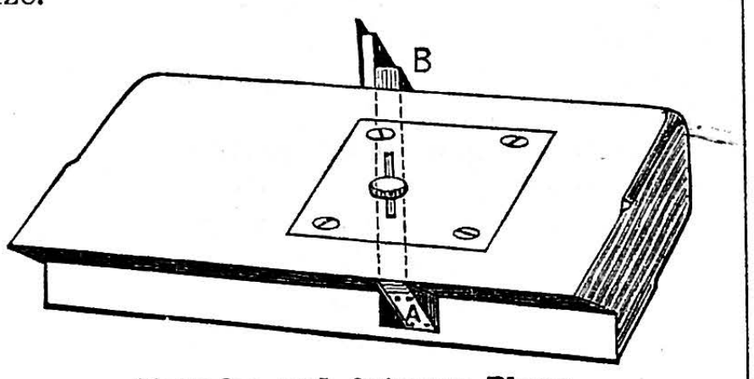
CHAMFER AND OCTAGON PLANE.

BY J. CHARLES KING.

PERFECTION of tools leads to confidence, ease, and simplicity of manual labour.

For working chamfers or octagons accurately a plane that does it truly is a useful addition to a set of planes.

The sketch of the plane shows that the face is a right-angle recess, and the mouth of the plane has a flat metal gauge, A, which fits nearly close to the plane-iron edge. This metal gauge is altered up or down, just as a wide or narrow chamfer may be wanted. If set to $\frac{1}{4}$ in. chamfer, it will take it exactly and truly, saving gauging edge-marks or using a bevel to test accuracy; so on up to $1\frac{1}{2}$ in. chamfer, as the metal gauge, A, may be brought lower in the wider angle. The screw seen on the side of the plane works up a slot, shown there in the plate. This screw, when tightened, holds the mouth-gauge secure. The casing-up, in which the metal mouth moves (B), is shown in front of the wedge that holds the plane-iron securely, and is $\frac{1}{4}$ in. wood-casing, let into the usual opening in a plane for the shavings to work out of. The dotted lines show this mouth-opening. For octagon rods or bars, of course, it would serve the purpose of truing them when roughly chopped to the proposed size.



Chamfer and Octagon Plane.

Of course, two truly square edges are essential for the plane-faces to work by to ensure truth of octagon or of chamfer. It is not yet a shop-made tool for general use, but it is not difficult to make.

WHY A NAIL HOLDS.

BY PROF. HENRY ADAMS.

IF one faculty is of more importance than another to the human race, it is the faculty of observation; and the cultivation of this is the true scope of education. Even the simplest every-day surroundings may be made subservient to this purpose; and it is astonishing how much the enjoyment of life is increased by what is generally called "keeping your eyes open." Technical education is merely a particular branch of the general subject; but the advantage of observation applies with tenfold force. For instance: a very simple experiment, which anyone with a hammer and a few nails can make, will throw considerable light on the reason why a nail holds different pieces together. If a piece of straight-grained deal, about 2 in. wide and 1 in. thick, be taken, and a line marked along the centre of one of the narrow sides, various nails may be driven in a row, about 1 in. apart, and the piece may then be split down the centre line, so as to expose the nails throughout their length. The smooth wire nails, called French nails, will be found to have penetrated the wood with very little disturbance of the surrounding fibres; and, as a consequence, they go in easily, and will draw out again with great facility. What hold they have is chiefly by friction from the compressed fibres re-acting against the sides of the nails. On the other hand, a 3 in. floor brad, which has a flat square point, produces great disturbance in the fibres. Immediately under the point they are crushed and pushed downwards, carrying others partly down with them, so that they press against the sides, and at the same time point downwards. It will be observed that every little group of fibres is like a strut pushing against the nail, and preventing its withdrawal. This experiment may be varied indefinitely, and the effect of boring holes before driving the nails can be studied. The difference also between the hole produced by a gimlet, a sharp bradawl, and a blunt bradawl will be instructive. Go and try it.

HOW TO LEARN DRAWING OFFICE WORK.

BY ARTHUR BOWES, A.M.I.C.E.

DRAWING PEN, DESCRIPTION AND CARE OF—POCKET DRAWING PEN — REVERSIBLE PEN — ROAD PEN — DOTTING PEN — SWIVEL PEN—COMPASSES—HAIR DIVIDERS—SPRING BOWS — PUMP PEN.

Choice and Care of Drawing Pen.—In the choice of a drawing pen there are several points which may be looked to with advantage. In the first place it is advisable to choose an instrument which has a strong and rigid bottom blade which will not give with any slight increase of pressure against the edge of the set-square or straight-edge; any flexibility in this direction being naturally to the detriment of the regular thickness of the line which is being drawn. A good shape of handle is the one shown in Fig. 26, where a square portion is formed at the lower part. This is useful in preserving the proper direction of the nibs of the pen when drawing. For cleaning the pen after using, a precaution which should never be neglected, it is convenient, though not absolutely necessary, to have one of the blades hinged so as to lift up and admit of the dried Indian ink being scraped off the inner side of the blades with a penknife. This hinge is shown in the same illustration, Fig. 26. If a small piece of chamois leather be kept at hand, and a corner of it pulled through the nibs of the pen after using, it will generally be found sufficient to keep the pen thoroughly clean. For scraping off any dried Indian ink, either the thin blade of a penknife may be inserted between the blades of the drawing pen, or a steel writing pen with half of the nib broken away may be used. The adjusting screw for setting the pen to various thickness of lines is very often made with too small a head: one of the best arrangements in this direction is that in which the milled head is placed between the blades of the pen, and the latter are adjusted by right and left-hand threads on the screw to which the milled head is attached. The head in this formation of instrument is of a more convenient size, and there is no liability to lose the screw out of the pen. Some drawing pens are made with the ivory handle to unscrew and serve as a pricker or station pointer. This form is not to be recommended: it necessarily weakens the instrument at the screwed joint, and there is little economy in providing in this way a tool which can be made in five minutes by any draughtsman.

Setting the Drawing Pen.—As the pen is more used than any other drawing instrument, it occasionally requires setting or sharpening. This is not a very difficult matter to do

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with a little practice, especially after seeing the operation performed, yet many draughtsmen make a practice of sending their pens to the instrument makers to be set. A slip of Arkansas or Turkey stone should be used, or even a piece of common slate, and it will be found better to use water for the lubricant rather than oil, as the latter is difficult to remove from the pen, and prevents the ink being taken up freely. In setting the pen, each nib should be brought to a rounded chisel edge, as shown to an enlarged scale in Fig. 27, and it is imperative that both nibs shall be of exactly the same length, so that when the pen is held upright they shall both bear evenly on the paper. A drawing pen of good hard steel that will keep its edge for many months without being set is a boon to its owner. With a view to securing this durability some pens are made with agate-pointed nibs, but so far as the writer has seen they do not give satisfactory results.

Pocket Drawing Pen. — It is often convenient to be able to carry a drawing pen about with one ready for use, for much can be done with this instrument alone by a mechanical draughtsman who is also a good freehand draughtsman. A pocket drawing pen is shown in Fig. 28, and will be seen to consist of a case or hollow handle in which the nib is carried secure from damage. When required for use the nib is unscrewed, and again screwed into the handle in a reversed position.

Reversible Pen Nibs.—In Fig. 29 is shown a device by which two complete pens are carried in the one handle. The nibs are reversible, and when one set is worn blunt the other can be brought into use in a moment. The milled head which actuates the adjusting screw is placed between the blades as recommended above.

Special Adjusting Pen.—An arrangement by which the drawing pen can be adjusted so as to give a definite thickness of line, and can at any future time be instantly adjusted to the same thickness, is shown in Fig. 30. The milled head of the adjusting screw is larger than in the ordinary pattern of drawing pen, and is graduated to show the varying distance between the nibs. A spring catch engages into the milled head and prevents the adjustment being inadvertently disturbed.

Road Pen.—For drawing parallel lines moderately close together, as in indicating roads, canals, or railways in maps and small scale plans, a double pen, such as is shown in Fig. 31, is a very convenient instrument. It consists essentially of two separate pens connected by a forked spring, with a screw and a milled head for regulating the distance between the pens. It is particularly useful where the lines to be drawn are curved or of irregular form.

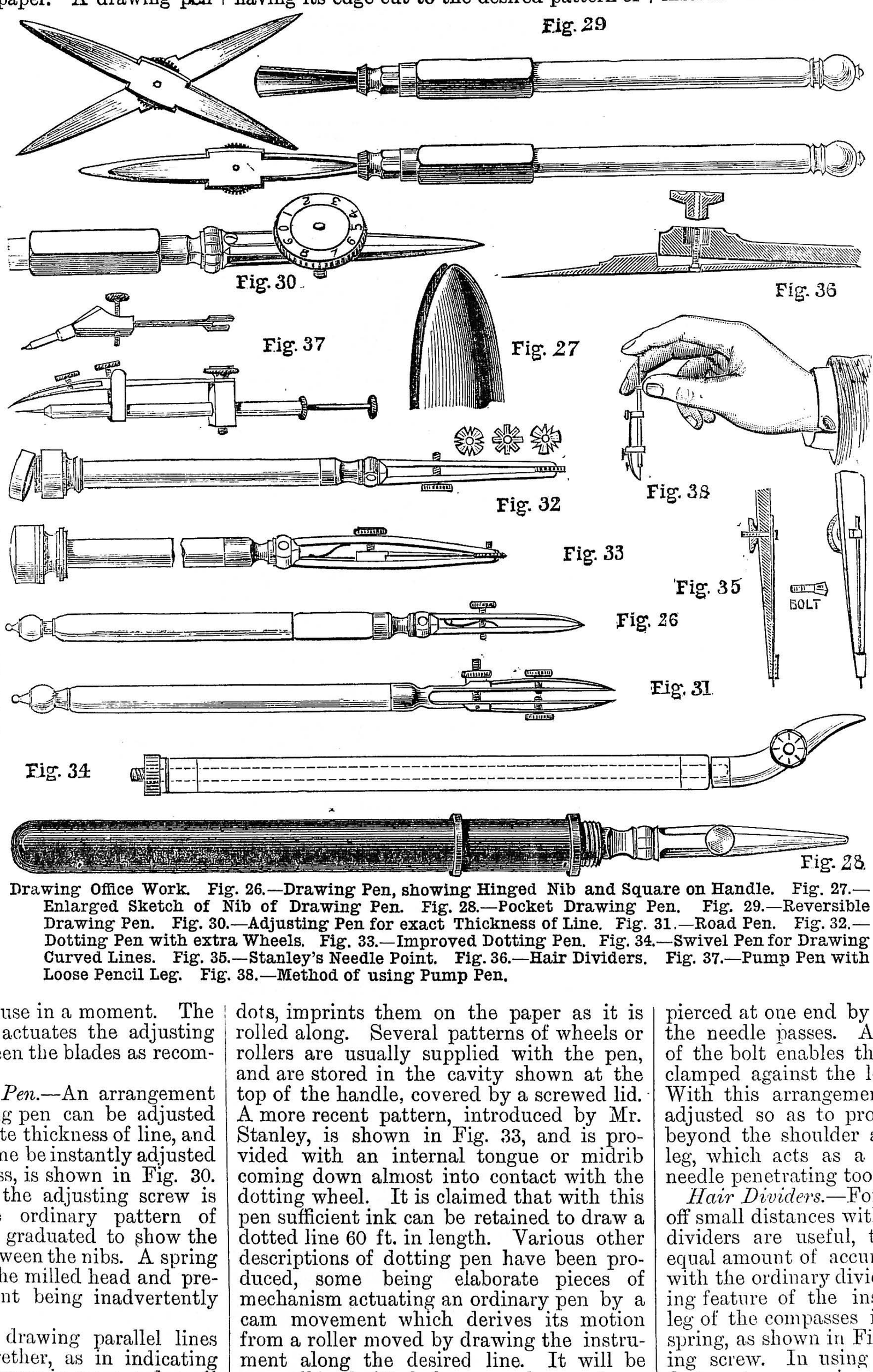
Dotting Pen.—For the purpose of drawing lines composed of dots of various shapes, dotting pens are made, the ordinary pattern being such as is shown in Fig. 32, where a small roller or rowel is fixed between the nibs of the pen. The ink is filled in between the nibs with a small brush, and the roller having its edge cut to the desired pattern of dots, imprints them on the paper as it is rolled along. Several patterns of wheels or rollers are usually supplied with the pen, and are stored in the cavity shown at the top of the handle, covered by a screwed lid. A more recent pattern, introduced by Mr. Stanley, is shown in Fig. 33, and is provided with an internal tongue or midrib coming down almost into contact with the dotting wheel. It is claimed that with this pen sufficient ink can be retained to draw a dotted line 60 ft. in length. Various other descriptions of dotting pen have been produced, some being elaborate pieces of mechanism actuating an ordinary pen by a cam movement which derives its motion from a roller moved by drawing the instrument along the desired line. It will be generally admitted, however, by most experienced draughtsmen, that a dotting pen of any kind is an instrument which can easily be dispensed with, and, indeed, is of little, if any, service to an expert workman.

Swivel Pen.—A pen especially designed for drawing curved lines is shown in Fig. 34. The handle is tubular, and through it there runs loosely a metal shank, to which the pen is attached. At the top is a small nut or milled head, by turning which the pen can be clamped up tight so as to form practically one piece with the handle, and in this fashion can be used in every way the same as an ordinary drawing pen. When the nut is loosened, however, the lower part of the instrument is free to revolve independently of the handle, and follows the direction of a curved line with great freedom. Although rather awkward to handle without considerable practice, it is a convenient instrument for the purpose for which it was designed.

Compasses.—This term is generally used to include dividers and pen and pencil compasses. The ordinary forms and methods of using these instruments are too well known to need more than the shortest reference here. Electrum is the best material for their construction on account of its lightness and freedom from liability to tarnish. The legs should be jointed, and needle points should be chosen as causing less damage to the drawing-paper, and admitting of greater accuracy in their use.

Needle Points.—There are several descriptions of needle points made, perhaps the best being that shown in Fig. 35, and patented by Mr. W. F. Stanley. In this the needle is held by a small bolt, pierced at one end by a hole through which the needle passes. A nut on the outer end of the bolt enables the needle to be firmly clamped against the leg of the instrument. With this arrangement the needle can be adjusted so as to project a very little way beyond the shoulder at the bottom of the leg, which acts as a stop to prevent the needle penetrating too far into the paper.

Hair Dividers.—For comparing or setting off small distances with great accuracy, hair dividers are useful, though with care an equal amount of accuracy can be obtained with the ordinary dividers. The distinguishing feature of the instrument is that one leg of the compasses is fitted with a steel spring, as shown in Fig. 36, with an adjusting screw. In using the instrument it is first set approximately to the desired



Drawing Office Work. Fig. 26.—Drawing Pen, showing Hinged Nib and Square on Handle. Fig. 27.—Enlarged Sketch of Nib of Drawing Pen. Fig. 28.—Pocket Drawing Pen. Fig. 29.—Reversible Drawing Pen. Fig. 30.—Adjusting Pen for exact Thickness of Line. Fig. 31.—Road Pen. Fig. 32.—Dotting Pen with extra Wheels. Fig. 33.—Improved Dotting Pen. Fig. 34.—Swivel Pen for Drawing Curved Lines. Fig. 35.—Stanley's Needle Point. Fig. 36.—Hair Dividers. Fig. 37.—Pump Pen with Loose Pencil Leg. Fig. 38.—Method of using Pump Pen.

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measurement by opening the legs in the usual way, and the final adjustment then made by turning the milled head of the adjusting screw.

Spring Bows.—For fine work the small spring bows sold in sets of three, comprising dividers and pen and pencil bows, are indispensable. They are among the best known of all instruments, and as there is nothing that calls for special remark about them, it will not be necessary to describe or illustrate them here.

Pump Pen.—A form of spring bow which is known as the "pump" pen is shown in Fig. 37. In this the centre point consists of a straight steel rod about 4 in. long. The pen or pencil is attached to a tube or sleeve which revolves freely around the steel centre. The method of using is to place the forefinger of the right hand on the top of the centre rod, placing the latter vertically on the paper, then to rotate the pen with the other fingers of the same hand while holding the centre rigid. By this means the sliding of the centre point and consequent tearing of the paper are rendered impossible. The pen and pencil points are interchangeable, and as a much larger circle can be described with this instrument than with the ordinary spring bows, it is a useful article. The method of holding it when in use is illustrated in Fig. 38.

ELECTRO-MOTORS.

SIEMENS' H GIRDER TYPE: THEIR MOTIONS, ETC.

BY J. BROX.

INTRODUCTION—MAGNETS AND COILS—POLE TO POLE — COMMUTATOR — MOTOR IN SERIES — MOTOR IN PARALLEL—WITH TWO BATTERIES —FINAL REMARKS.

Introduction.—This form of motor has been chosen partly because of its simplicity of construction, and partly as it is such a favourite form for small motors with the amateur; also because there are many professional workmen, who have been employed for some time making and putting together such motors as the Griscom, etc., who are still unable to say why they go round, or why they go in a certain direction. I shall endeavour in this paper to make these facts clear to all, by illustrating some of the laws that govern this type of machine, without in any way going into the subject of construction. This task that I have set myself I am going to try and perform with the use of as few technical terms, etc., as I can, so that all may understand.

Magnets and Coils.—The first and principal rule to understand is what happens when a length of covered copper wire is wound round a bar of soft iron, and a current of electricity is passed through the wire. I shall take it for granted that you know the iron becomes a magnet as long as the current flows; but there are other laws to be considered of great importance to us at present.

Take, for instance, a small bar of iron, as in Fig. 1; hold one end in your left hand, and commence winding from your left hand towards the other end as the hands of a clock turn—that is, away from you on top of the iron, and towards you underneath. If you now pass a current of electricity through the wire coil, from the left-hand tag end to the right-hand tag end—that is, the carbon of a battery cell to the left hand, and the zinc to the right—the end of the iron you have in your left hand becomes a north pole of a magnet, and the end that is at your right hand becomes a south pole.

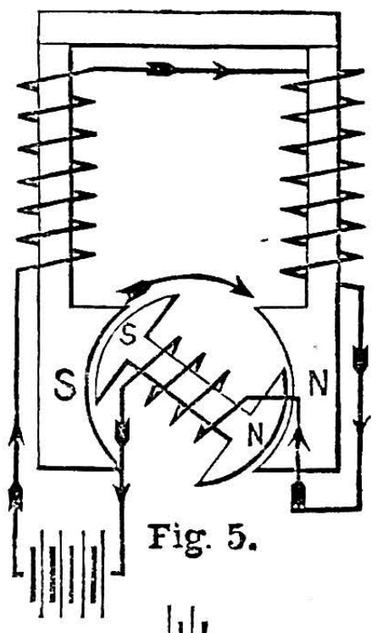
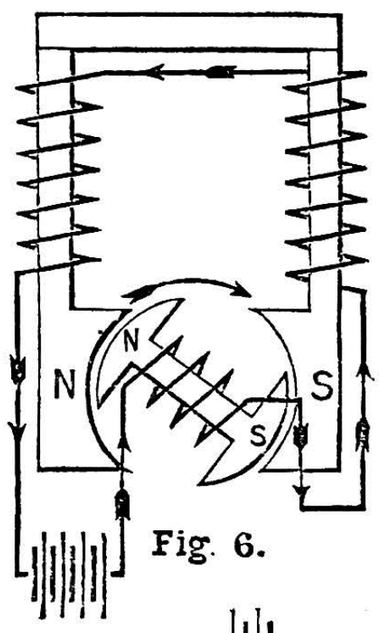


Fig. 5.



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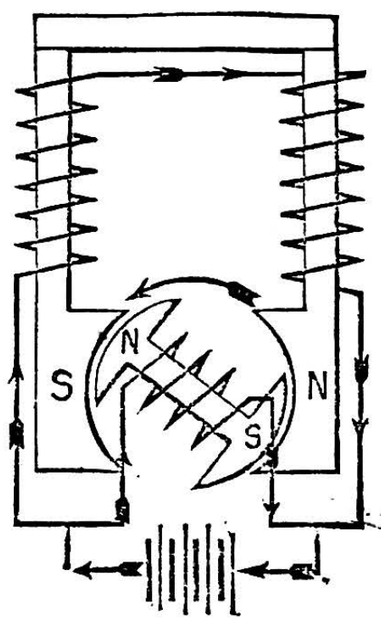

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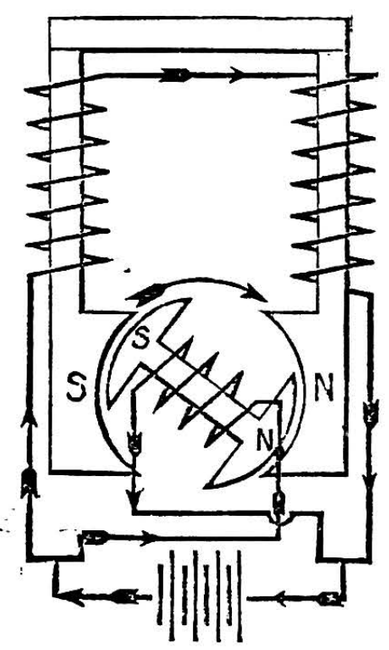

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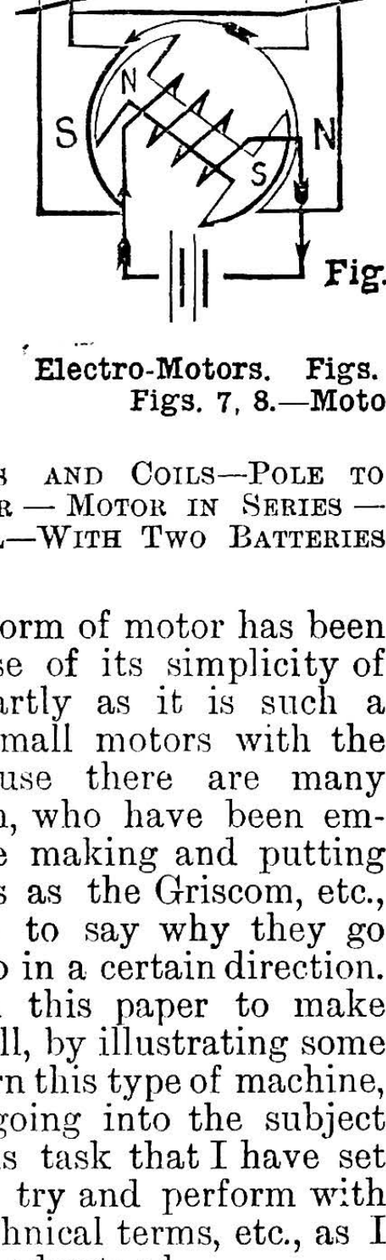

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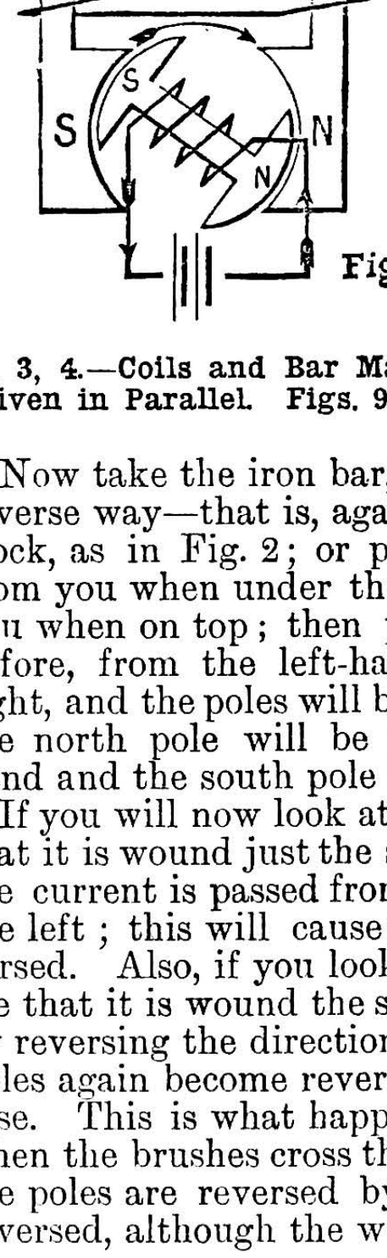

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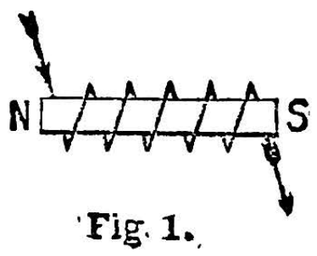
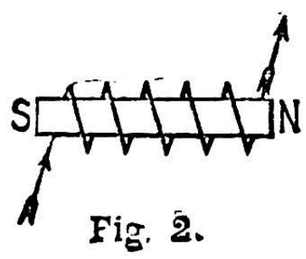


Fig. 1.



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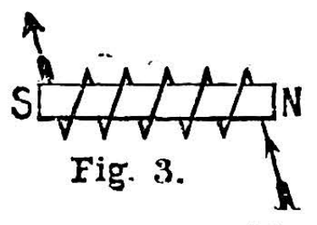

Fig. 3.

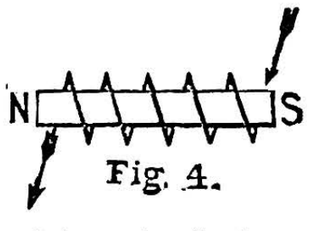

Fig. 4.

Electro-Motors. Figs. 1, 2, 3, 4.—Coils and Bar Magnets. Figs. 5, 6.—Motors driven in Series. Figs. 7, 8.—Motors driven in Parallel. Figs. 9, 10.—Motors driven with Two Batteries.

Now take the iron bar, but wind it in the reverse way—that is, against the hands of a clock, as in Fig. 2; or pass the wire away from you when under the iron, and towards you when on top; then pass the current, as before, from the left-hand tag end to the right, and the poles will be reversed—that is, the north pole will be nearest your right hand and the south pole in your left.

If you will now look at Fig. 3, you will see that it is wound just the same as Fig. 1, only the current is passed from the right hand to the left; this will cause the poles to be reversed. Also, if you look at Fig. 4, you will see that it is wound the same as Fig. 2; but by reversing the direction of the current the poles again become reversed, as in the other case. This is what happens in an armature when the brushes cross the insulating strips: the poles are reversed by the current being reversed, although the winding remains the same.

A very good way to master this rule is to do as I did—some years ago now. Perhaps I was rather thick, but I was determined to be the master. I got a bit of wood, and marked one end "S" and the other end "N"; then a piece of string. On one end I had a small label, upon which I wrote "+," or positive; on the other end another label with "—," or negative, upon it. With this amusing toy I used to practise at odd times, until I was able, at a glance, to tell what was what.

Pole to Pole.—The next great law to be observed is short and important. If you bring two poles of the same kind near each other, they will repel one another; if you bring two different poles together, they will be attracted—that is, *north to north*, repulsion; *south to south*, repulsion; but *north to south*, attraction.

Commutator.—In the diagrams of motors (Fig. 5 to Fig. 10), the commutators and brushes have been left out, in order to make the drawings as simple as possible; but it must be clearly understood that, when the two poles of the armature are opposite the two poles of the field-magnets, at that moment the two brushes are resting upon the insulating strips of the commutator; immediately after that (the armature being in motion), the current is changed through the armature and its poles reversed. This is not exactly absolutely the fact in practice, but in this case, for theory, we must assume it to be so.

Motor in Series.—Let us now investigate a motor of our type driven in series—that is, the current passing first through the magnets, then through the armature, and so back to the battery—or the reverse: *i.e.*, through the armature first, then the magnets, and so back to the battery, as in Figs. 5 and 6. It may appear a curious fact, but whichever way you send a current through a motor, when in series as shown, it will rotate the same way.

Let us take Fig. 5, and follow the winding, starting from the battery. We will suppose that you wind as the current flows. The first magnet core that you come to is the left-hand one; this, you will observe, is wound as the iron bar in Fig. 4, and, if you have understood the foregoing law, you will see that you leave a south pole behind you. Crossing over to the other core, you wind against the clock, which brings you up to a north pole. After this the current goes to a brush, then through the commutator (which are not shown), and into the armature, which is wound, as you will observe, as the bar in Fig. 3—a north pole to the right hand and a south pole to the left. After this, the current again goes through the commutator and the other brush, and returns to the battery.

If you will now look at the position of the armature in diagram (Fig. 5), you will see

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that I have drawn it just a little off the straight, so that the brushes are not on the insulating strips, but are in contact, so the current will flow through the whole machine. Now see what happens. There is a south pole of the armature against, or near to, a south pole of the magnets, and a north pole of the armature near a north pole of the magnets. This means repulsion directly, so that the motion the armature takes is as indicated by the curved arrow above it; which, by the way, shows the motion in all the diagrams. Now, this motion continues until the south pole of the armature nears the north pole of the other magnet; then, as they are of different poles, they will attract each other until the south pole of the armature has arrived exactly opposite the north pole of the magnet. At that moment the brushes cross the insulating strips, and change the poles of the armature, and our south pole, in the armature that was, becomes a north, and then like poles are again together and repulsion commences, causing a continuation of the same motion.

If you now reverse your battery, as in Fig. 6, and follow out the winding, you will find that every pole has been changed, so that again we have like poles to like, which causes the motion to be the same as in Fig. 5. This means that, if a motor is driven in series, the motion will be in the same direction whichever way the current goes.

Motor in Parallel.—We will now consider what happens when we drive our motor in parallel; that is, the current from the battery is divided—part is shunted to the magnets, and part to the armature. After the divided current has passed through the machine they again meet in one wire and return to the battery. If you will follow the windings, and the direction of the current in Fig. 7, you will see what is meant; you will observe that the left-hand magnet is the same as Fig. 5, and will be south; the other must, of course, be north, as the two magnets must always be wound so as to be of different poles. Now follow out the branch of the current which passes through the armature; this will enter on the left-hand side and be wound with a coil, going with the hands of a clock. As in Fig. 1, this will give a north pole to the left, and a south pole to the right; the current then goes through the commutator, etc., and joins the current from the magnets, and so to the battery.

In this case you will see that you have unlike poles near each other; this causes attraction, and the armature rotates in the opposite direction to both Figs. 5 and 6.

Now see what happens when you reverse the shunted part of the current through the armature, and leave the part of the current through the magnets as it was. Fig. 8 will show you this. You have like poles to like, causing repulsion, and the motion of the armature is reversed, turning the same as in Figs. 5 and 6. You would also get a reversal by reversing the current through the magnets, keeping the current in the armature the same as in Fig. 7.

With Two Batteries.—For further explanation, we will suppose that you drive your motor with two batteries instead of one—viz., one to excite the magnets, and the other the armature, as in Figs. 9 and 10. If you now follow out the windings, and the direction of the current, as you have done in all the other cases, you will be able to see what happens and which way the armature will move. Here, as in the case of the motor driven in parallel, if you reverse the current in either the magnets or the armature, you will reverse the motor.

Final Remarks.—You may, perhaps, have noticed that all the diagrams, from Fig. 5 to Fig. 10, are in fact all wound the same way; this has been done to show some of the different ways that one motor can be driven, by making different combinations with the current. If I had drawn all the combinations in windings and all the combinations in currents that were possible, I should very nearly half fill up one whole number of WORK; but as there are many more combinations than those that I have shown, you will find it of use to yourself if you sketch out a few skeleton diagrams, and put the windings and currents in in different ways to these, and work out the motions yourself.

Let us take an example. You are an amateur, and have just bought the castings of a small model H girder motor; but you are very anxious that it should work in the reverse way to Figs. 5 and 6, when driven in series. Now, all you have to do is to wind the magnets as in Figs. 5 and 6, but in winding the armature you must wind it as in Fig. 4; or, on the other hand, wind the armature as it is in Figs. 5 and 6, but reverse the twist in the magnets. Then you will have a motor that, when driven in series, will have a reverse direction to that in Figs. 5 and 6.

All this may seem very complicated, but it is, in fact, very simple—once having mastered the law of winding a simple bar of iron, and always remembering that two like poles repel, and two unlike poles attract each other.

As a final remark, I trust that none of my readers who have good motors will try any of these experiments upon them, as the chances are they will ruin their machines. Always drive your motor with the current for which it was built. If you want to try these sort of experiments, rig up a small motor for yourself, which will do no harm if you do happen to ruin it.

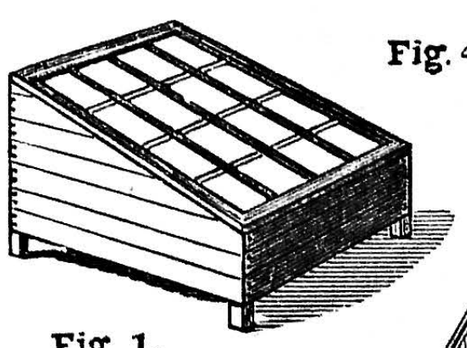
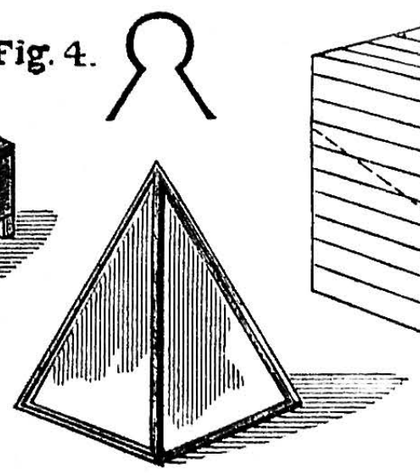


Fig. 1.



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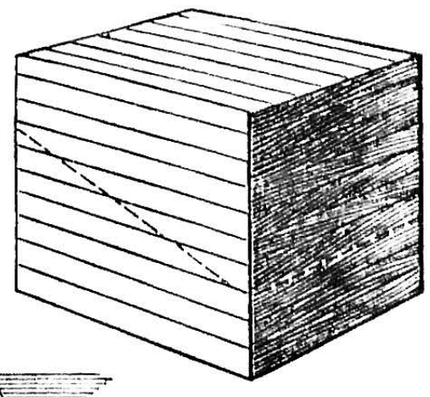

Fig. 2.

Fig. 4.

Utensils for the Garden. Fig. 1.—Completed Frame. Fig. 2.—Showing Construction of Two Frames from Packing-Case. Fig. 3.—Hand-Glass. Fig. 4.—Section of Zinc Sash-Bar.

SIMPLE UTENSILS FOR THE GARDEN.

BY C. MAYNARD WALKER.

A PROPAGATING FRAME.

ONE of the most useful articles in connection with gardening is a propagating frame, to be used as a cold frame alone or over a hot bed; and although it is useful at all times of the year, it is especially so in the spring, when one is anxious to get forward seedlings and growing plants; so we will take that first (Fig. 1). It is a very easily constructed piece of work to anyone who is accustomed to the use of the simplest tools; the question of size is one that each must determine for himself, having regard to the position in the garden it is to occupy; and the cost will vary, of course, not only as to the size, but the quality and substance of the material. And here let me say that to anyone living in London or other large town, where a large packing-case can be readily bought for a trifle, a somewhat rough but just as useful a frame can be very cheaply and easily turned out. I have two of this kind in use. I bought a packing-case, which measured 3 ft. 6 in. long by 2 ft. 4 in. wide and deep, and, having marked it off as in Fig. 2, I cut with a rip-saw the two frames from the one box, taking care to nail up securely the top and bottom of the box before sawing it, so as to keep it rigid; afterwards removing them, as, of course, the frame does not require any wood on the underside. But, failing any such opportunity, we must make our frame with new wood. The measurements given above will be found to be convenient for general purposes. Deal, about ¾ in. or 1 in. thick, should be used for the sides, and 1¼ in. for the uprights, which should be a few inches deeper than the frame. If the worker is not accustomed to rough joinery, he will better ensure truthfulness in the completed work if he temporarily battens together the planks which are to form the two longest sides by nailing two strips of wood across them at both ends, then sawing the planks to the required measure and slope, and attaching them to the uprights, leaving a space the thickness of the end planks; then, having cut up the latter, put the whole together with 2 in. French nails. A true and substantially made frame should be the result.

The glass frame for the top should be very strong. The outer frame should be not less than 1 in. thick and 3 in. wide, made on the flat; and if the measurements referred to be adopted, three sash-bars should be fixed lengthwise, and equidistant from the edge of the frame. Sash-bars in lengths can be bought at almost any timber-yard; but if not, can be readily roughed-up by joining, say, a strip of wood, ½ in. thick, upon another, say 1 in. These must be securely fitted to the frame, and should be let in the wood at both ends, as well as nailed. Give the frame a coat of paint before glazing, and for the latter purpose use common window-glass—costing 2d. or under per foot—and ordinary putty. The glazed frame is better adapted to retain warmth when the edges are "lipped," by fitting all round vertical strips of wood, so that the lid of frame laps over the lower part a convenient space—say, 2 in. The earth is usually dug out to form a manure-pit. It is very convenient to have a number of hand-lights (Fig. 3), which can be temporarily covered over newly-planted-out things. These can be made very cheaply. Ready-drawn zinc sash-bar can be bought in 8 ft. lengths at any zinc-worker's. This material has a round bead and a rebate on either side (Fig. 4) about ⅛ in. wide. To make a hand-light, you have to simply cut up the zinc into the required lengths and solder them together, so as to form a triangular or any shaped frame, which, being glazed with common glass, forms a most handy and useful garden appliance.

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"WORK" PRIZE SCHEME.

NOTICE.

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will be found on page 240.

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ELECTRICAL SURVEYORS.—Judging from the discussion which took place between witnesses, experts, and the jury in connection with the recent fatal fire at a famous London supper room, there would seem to be more danger in connection with electric lighting than the general public suppose. In answer to the question of a juror: "Do you consider that the fire was caused by the electric light?" an expert responded, "I think it is distinctly possible, but I find no definite tangible evidence to that effect"—an answer which admits the fire risks involved in electric lighting and fittings. Far be it from us to discourage the use of the electric light, or to shut our eyes to the fact that the new illuminant will not only eventually succeed gas, but will prove the great propelling and motive power of the future. On this very account, however, and because it is likely to become so generally adopted for social and commercial purposes, we submit that the question of thoroughly qualified and duly accredited inspectors for work carried out becomes a matter of moment—one which the London County Council and Local Government Boards should grapple with without loss of time. When the electric light surrounds us on every side, and wrests the palm from gas in our every apartment, what will be the emergency qualities of the average domestic, or even the *major domo?* After many years' experience with it, the fashion remains of seeking for an escape of gas with a lighted candle, and if this ignorance prevails in respect to gas, what shall we say for the mysteries involved in electric lighting with its systematically concealed wires and fittings? The subject of electrical training and qualification is now of paramount importance, and the powers that be cannot too soon commence to take steps to establish a system of properly qualified practitioners in the science, whose work, when done, shall be subject to being passed by the electrical surveyor or inspector. These latter should be men who have given proof by examination of qualifications as electrical scientists. An electrical college, empowered to grant diplomas, would find ample work before it in the near future, both as regards training classes for electrical students and empowering them to practice as soon as qualified. Certainly these would be the better men to carry out electric lighting with safety to life and property, and with the insurance companies in a contentious mood concerning claims from electric light mishaps, many wise people will defer their installations, preferring the miseries of gas until they can be assured of absolute safety with the new illuminant. Unless this subject of electric lighting be put upon some such basis as this, and the touting tradesman debarred from undertaking work he knows nothing about, the public may one day find itself in a fog in real earnest, for though, curiously enough, all the cunningly devised appliances for effecting capital punishment by electricity seem to fail, it appears ridiculously easy to court a simple and instantaneous death—when not required—by the mere accidental acquaintance with electric currents and wires.

DEVELOPMENT OF INVENTIONS. — Although it is undoubtedly the fact that a majority of the inventions of our times fall into oblivion through inutility or lack of novelty, yet it must be admitted that many inventions genuine and novel, and of real value, are lost by reason of the inventor's want of capital and influence. This is to be regretted not only on account of the inventor himself, but also in the interests of the community at large. The unwritten history of inventors is far from being encouraging—we get glimpses of it at times; the originators of new ideas do not often reap their reward if they have not the sinews of war wherewith to fight the financial battle, without which very few new inventions can reach the market. Inventions in their workable forms must come from practical men, and those who are intelligent enough to improve our methods and machinery should be encouraged in exercising their faculties of originating and improving. Societies and institutes have been founded with this view, but matters at present do not seem to be better in this respect than they were twenty or thirty years since. A new association has now been registered to take up inventions with a view to their development, but it remains to be seen whether its mode of procedure will be beneficial in the way of rescuing useful inventions from neglect. There are some very delicate points to be dealt with in considering the advisability of taking up an invention and spending money on testing its utility. It is, to a great extent, a speculation; there may be a market for a certain machine promising a rich return, and a short time after the completion of such machine a cheaper or better one may be produced to compete with it, or even that which is produced by it may be displaced by other material. On the other hand, by overlooking the possibilities underlying a crude invention, great opportunities of advancement and profit may be lost. New discoveries and startling inventions are almost, if not quite, things of the past, but there is much more to be done in the way of perfecting than ever has been done in inventing, and it is sincerely to be hoped that the new association will prove to be a potent agency in aiding progress. We see no reason why an undertaking of this kind should not succeed, and if conducted upon sound business lines we believe it will be beneficial to inventors all over the country. Their views upon the matter ought to be heard, however, by the promoters of the association. WORK is open to them.

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CIRCULAR DESIGN FOR REPOUSSÉ, CARVING, MODELLING, ETC.

BY J. EADIE-REID.

THIS design, which is one of several which we hope to give in WORK, has been drawn specially with a view to its being of general value to our readers engaged in different pursuits—some repoussé, others carvers, decorators, etc.—modifying the details in each case to suit the peculiar method or material employed. The desire of the designer has already been enlarged upon in a former article—namely, that the designs submitted are intended to form the basis of suggestions to the art workman, to assist him in starting a train of thought of his own. Then, and only then, will he experience the keen pleasure that necessarily accompanies the realisation of our ideas; not merely to trace the lines of our illustration, but diligently striving to reconstruct the designs—to feel, as he works, the meaning and spirit of each detail, while the effect of the whole is preserved.

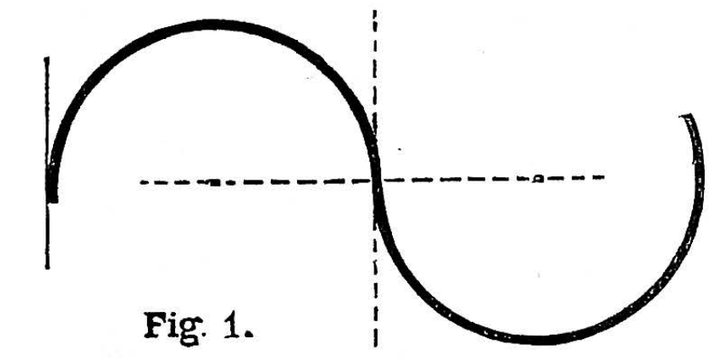
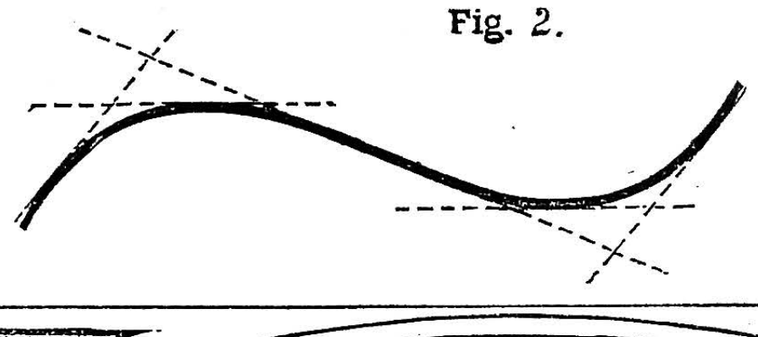
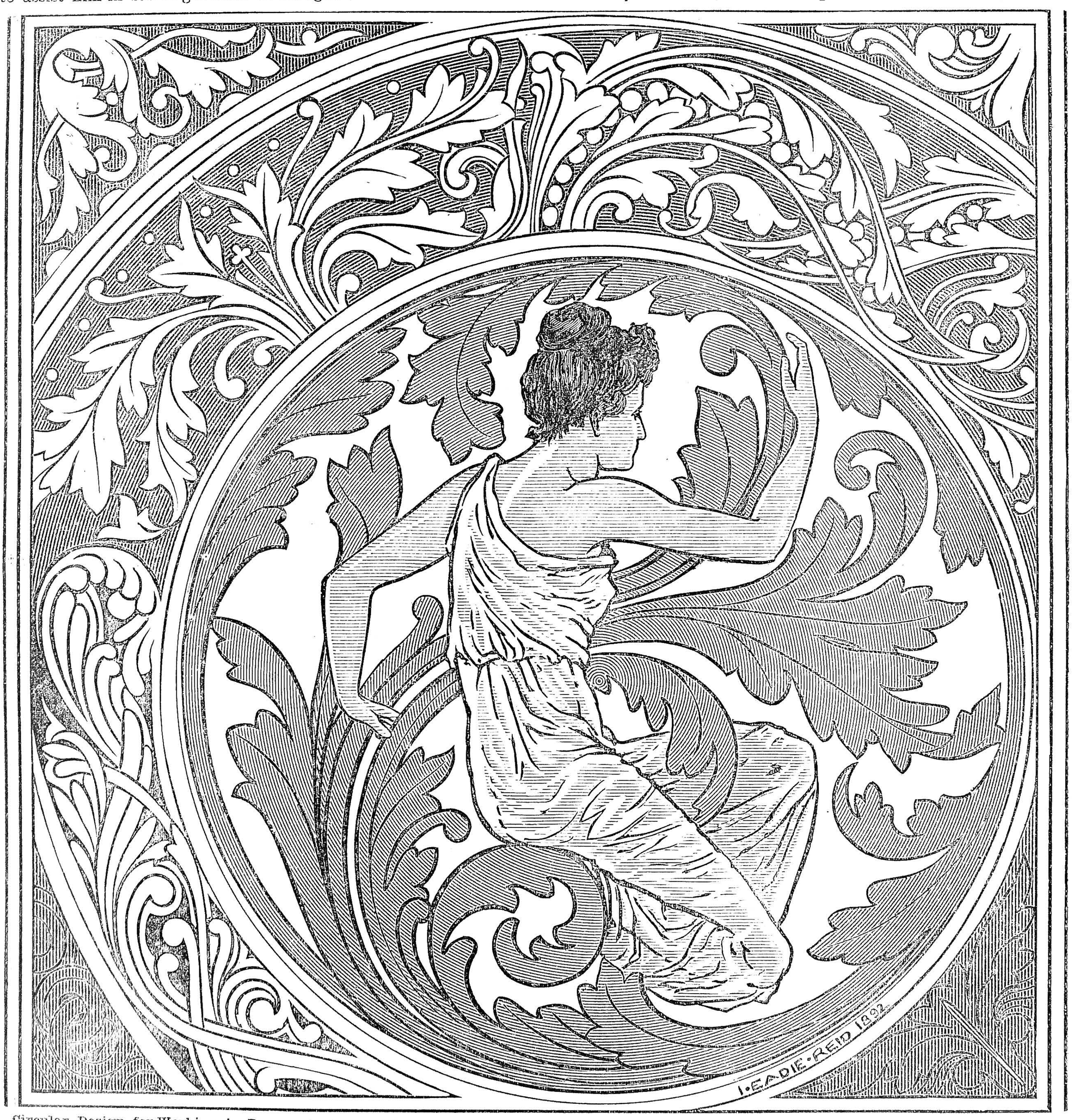


Fig. 1.

Fig. 2.



For instance, in drawing the ornament which fills the circular border, the leading lines form practically the skeleton or framework, and must be defined at the outset; otherwise, the whole will prove a disjointed failure. The circular lines of the plaque itself will suggest the inclination and direction of these lines. Having determined these, and made up our minds as to the manner in



Circular Design for Working in Repoussé, Carved Wood, or Painted Decoration, with Borders varied and cornered for Square, such as Tray.
Fig. 1.—Arc, as compared with Fig. 2 (Ellipse).

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which the ground-lines are to be clothed, we must draw the details firmly and deliberately. "He who hesitates is lost" is equally true of the ornamentist. Again, in the repetition of the forms we must be careful that the lines flow sweetly into one another; otherwise, we shall have the discordant effect of lines broken at intervals, and having no apparent definite connection with each other. Each line in itself is of vital importance to the whole; take it away, and its absence will be painfully evident.

In analysing the forms, you will find that the curves of the principal forms are elliptical.

We have not far to seek for an explanation of this. The eye is never satisfied with lines the origin of which can be detected without difficulty—as in the case of the arc, the least beautiful of curves—lines which in themselves bear evidence of thought being more pleasing, according to the degree of subtlety displayed. Take, for example, the ellipse, struck from three or more centres. A simpler method, perhaps, is to conceive the curve as formed of straight lines—the longer the better, in proportion to the scale on which you are working. (See Fig. 2, Ellipse.)

The figure forming the principal feature of the centre panel must be carefully drawn, separately, and transferred to its position. The proportions must be religiously preserved; otherwise, you will never succeed in keeping the grace and freedom of the pose.

The lines of the figure have been carefully studied in relation to their harmony with the space occupied. In treatment it must be strictly decorative, carrying the suggestion only as far as your material will allow.

We might say that in the carving greater finish in the details might be expected than would be found in the repoussé work; but the mass will still have the same effect.

The drapery will require careful studying, lest, while preserving the lines of the figure, you fall into the trap of making the drapery too "pipey." It will be seen, on looking at the border, that three different designs have been suggested for this feature. It is intended that one only should be used at a time.

Now as to the purposes our designs might be applied in decoration. The repoussé plaque has already been spoken of; to the china painter it will be found useful. The centre, modelled in terra-cotta, might be used in the carrying out of the design for a fireplace that appeared in No. 146, Vol. III. In painted decoration it would give scope to the decorator—used as a panel in a frieze—and afford a chance for a bit of glowing colour if treated on a gold background.

The fretworker could turn it to account, and the wrought-iron worker might not do amiss with it. Treated in silks and materials, or painted, it could be used for a pianoforte back.

MODEL BOAT-MAKING FOR BOYS.

BY A CRAFTSMAN.

MAST-HOLES — BINNACLE—CLEATS—ARRANGEMENT OF THE RIGGING IN CUTTERS AND SCHOONERS—MASTS.

We must now turn our attention to the mast-holes. These are bored in the deck with a centre-bit, and wooden sockets are fitted into them. One of these sockets is represented by Fig. 14. It is turned out of boxwood, and is fastened into its place with four small screws. The shape of the binnacle is shown in Fig. 15. It is also made of boxwood, and its upper part is hollowed out to contain the compass. It is fitted into the deck in the same way that the capstan is. The compass can be bought at any shop where models are sold, and should be less than 1 in. in diameter. The pieces of brass wire (M, Fig. 9, page 155) are shaped as shown in Fig. 16. The ends are pointed and hammered into the deck, care being taken not to split it. The cleats are made in wood and brass in the shapes shown in Figs. 17, 18, and 19. The kind of cleat represented by Fig. 17 is fastened down by two small screws passed through it, the others having pointed ends, so that they can be hammered into the deck. Fig. 20 shows the manner of mounting cannons with a swivel arrangement. The lower end of the support of the trunnion is pointed, so that it can be fastened on to the deck by simply hammering it in.

These are all the deck fittings which are generally used on model ships. If you do not care for the trouble of making them yourself, you can buy them beautifully made at the Model Dockyard. If you are constructing a one-masted vessel, the only difference in the arrangement of the deck fittings will be that only one mast-hole, two pieces of bent wire, two hatchways, and fewer skylights will be required.

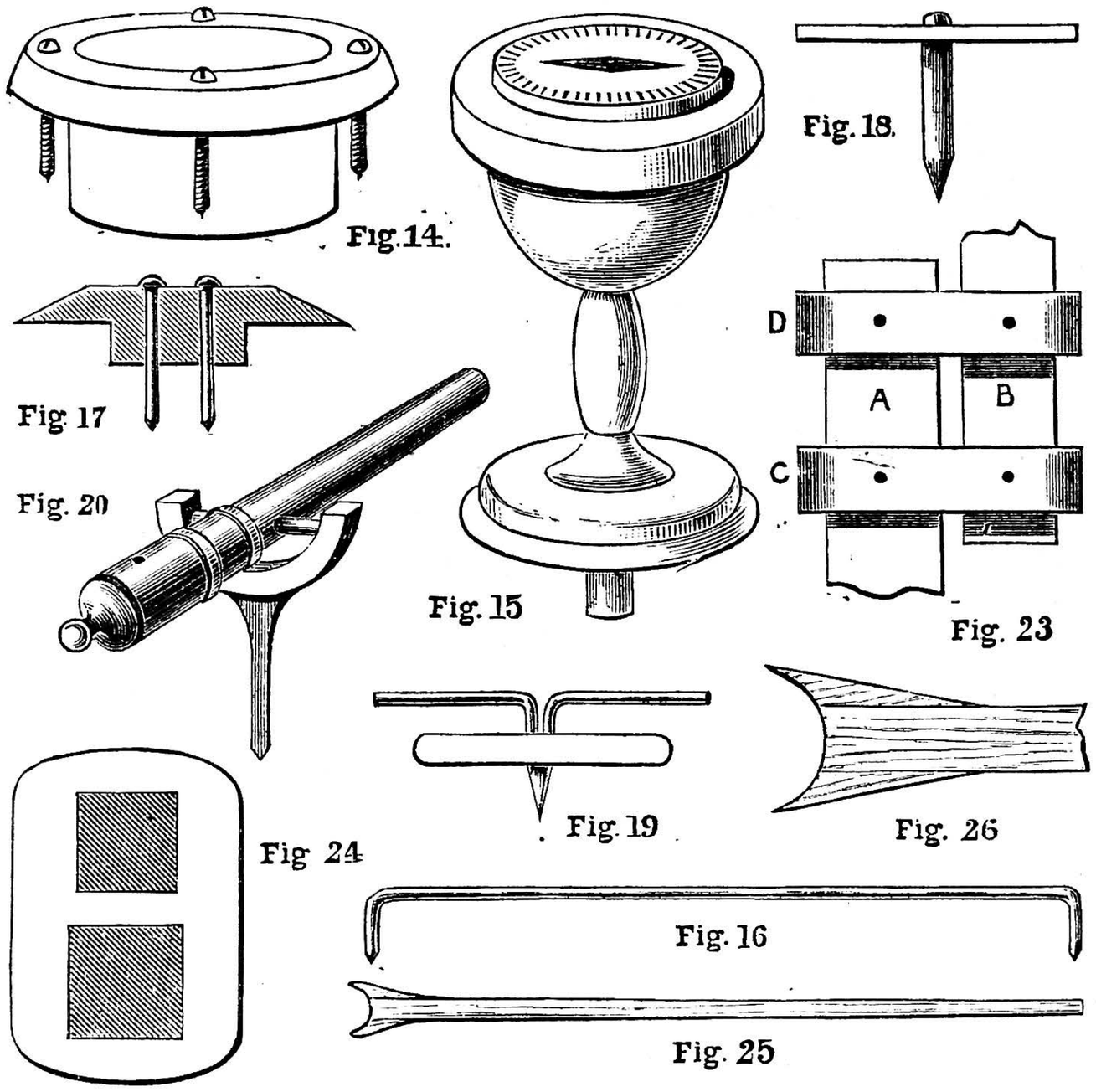
A few touches of paint must now be added to the hull and deck. All iron eyes and heads of screws must be touched up with black paint, and a few touches of red and black paint judiciously added to the skylights will improve their appearance. A figurehead can also, if you wish, be fixed on to the bows.

We must now turn our attention to the masts and rigging. Fig. 21 shows the manner in which a cutter is rigged. There is one mast, F, on the top of which is a topmast, N. It has a mainsail, A, a topsail, B, and jib and foresail, C and D. The mainsail is fastened to a spar, J, called the gaff, and to another spar, I, called the boom. The mast is supported by mainstays, G, and by a forestay, H. The bowsprit is secured by a stay, E, and two sidestays. The mainsail and foresail are fastened to rings which run along the wires, M (see Fig. 9), by pieces of string called "sheets." The sails are let up and down by pieces of string called halyards, which pass over pulleys down to the deck, where they are fastened round cleats. The mast is sometimes provided with two backstays (M, Fig. 21), which pass from the topmast and are fastened on to the outside of the hull, but nearer to the stern than the mainstays.

Fig. 22 is an illustration of the rigging of a fore-and-aft schooner. It has two mainsails, two topsails, a jib, and foresail. The topsail on the foremast, or on both of the masts, may be replaced by one or two square sails, when the ship will be a square-topsail schooner. The square sails add much to the appearance of the ship when she is upon the water, and make her sail with great speed before the wind; but they add greatly to the weight of the topmast, since three yards are required on each mast. In tacking, the yards are moved by halyards, which pass over pulleys fixed on to the opposite mast, and thence down to the deck.

Having settled on the manner in which you are going to rig your ship, proceed to make the masts and spars. Deal is the wood which is generally used for this purpose, but lancewood is greatly to be recommended, because it can be obtained in long strips, is of a good colour, is hard and flexible, and can be made very smooth. The masts are made of such a size that they will fit tightly into the sockets provided for their reception. The topmast is joined to the mainmast by the arrangement shown in Fig. 23, where A is the mainmast, B is the topmast, and C and D are two pieces of boxwood of the shape shown in Fig. 24.

The sharp part of a nail is driven into the lower part of the mainmasts, so that they will not be able to slide in the hold of the vessel. The ends of the topmasts are provided with boxwood or brass caps. Small brass eyes are fixed on to the mast in the



Model Boat-Making. Fig. 14.—Socket for Mast. Fig. 15.—Binnacle. Fig. 16.—Brass Slide for Sheets. Figs. 17, 18, 19.—Cleats. Fig. 20.—Swivel Cannon. Fig. 23.—Arrangement for holding Main and Topmasts together. Fig. 24.—Piece of Boxwood for fastening Masts together. Fig. 25.—Gaff or Boom. Fig. 26.—Part of Gaff or Boom which is next to Mast.

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various places where ropes are to be attached. The bowsprit is made to fit into the piece of wood which was fastened on to the deck for its reception, and a ring is rigidly fixed on to the bows for it to pass through. The gaffs and booms are made in the shape shown in Fig. 25. They should be made as light as is consistent with strength, and should taper almost to a point. The curved part clasps the mast, and is tied to it with a piece of string, but so loosely that it will easily slide up and down. It may be cut out with the spar, or made by joining pieces of wood on to the spar, in the manner shown in Fig. 26. An eye, to which the halyard is fastened, is fixed on to the upper side of the gaff, and another, to which the sheet is attached, is fixed on to the lower side of the extremity of the boom.

WORKERS' QUESTIONS: OLD AGE PENSIONS.

BY ECONOMICUS.

THE scheme furnished by the Parliamentary Committee as a basis for legislation on the question of pensions for the aged will, no doubt, evoke abundant criticism among workmen. Criticism, therefore, we shall dispense with just now, feeling sure that the first question every working man will seek an answer to will be: "What benefits does the scheme offer to me?" If these benefits are deemed sufficient, whether a man may agree in the abstract with pensions or not, he will endeavour to avail himself of them. Many a man objects to underground railways, but few hesitate to use them when their interests are served by doing so. Many of our readers may object to the design of a bridge, but none would refuse to use it any the less on that account if they so required. So will it be with the pension scheme. Whatever objections it may be open to on general grounds, it will be made use of, when legalised, just to the extent that it may serve the interests of individuals.

The easiest—*i.e.*, the cheapest—terms upon which a pension will be procurable are open to those under twenty-five years of age, and the age at which pensions are to become payable is sixty-five. Men under twenty-five are divided into two classes—viz., those insured in a friendly society or elsewhere for a pension of not less than £6 10s. a year on reaching the age of sixty-five, and those not insured elsewhere at all. To the former, an additional pension of £6 10s. a year, making in all £13 a year, or 5s. a week, will be paid by depositing £1 10s. in the Post Office Savings Bank. All a young man in this class has to do to get 2s. 6d. a week after he is sixty-five is to speculate to the extent of 30s. If he die in the meantime the 30s. is lost; if he survive he will, of course, soon realise more than his outlay.

Those under twenty-five and not insured elsewhere pay to the Post Office a deposit of £1 more—viz., £2 10s.—and then, for forty years, an annual deposit of 10s. For this, a total outlay of £22 10s., a pension of £13 a year, or 5s. a week, is payable at sixty-five. This is not a very substantial sum, and there are not many amongst the young who would forego much to struggle on in old age on 5s. a week. Perhaps, however, a pension of £1 a week or more might tempt them, and this may be secured by increasing the deposit or the annual instalments, or a judicious mixture of both. For instance, for every £1 added to the deposit of £2 10s. the pension may be increased 11s. 8d. a year, and for every 5s. added to the annual instalment of 10s. it may be increased £2 16s. 10d. a year. To bring the pension up to £1 a week, the yearly £13, due from the £2 10s. deposit and 10s. instalments, would have to be increased by £39. As every £1 deposited over and above the first £2 10s. brings only an addition of 11s. 8d. a year, and as there are close on sixty-seven times 11s. 8d. in £39, to get £1 a week pension will require an initial deposit of close on £70. This, of course, is impracticable for most young men under twenty-five. By the additional annual instalments of 5s. the pension is raised £2 16s. 10d. a year; to raise it by £39, therefore, would require close on fourteen additional 5s. instalments, or £3 10s. Thus, with a deposit of £2 10s. before the age of twenty-five, and annual deposits thereafter for forty years of £4, a pension of £1 a week is secured. Though a young man may lightly deposit £2 10s. and pay an annual sum of 10s., he may perhaps hesitate before beginning to pay £4 a year to the scheme, especially as, under the foregoing, the money is not returnable in the event of death.

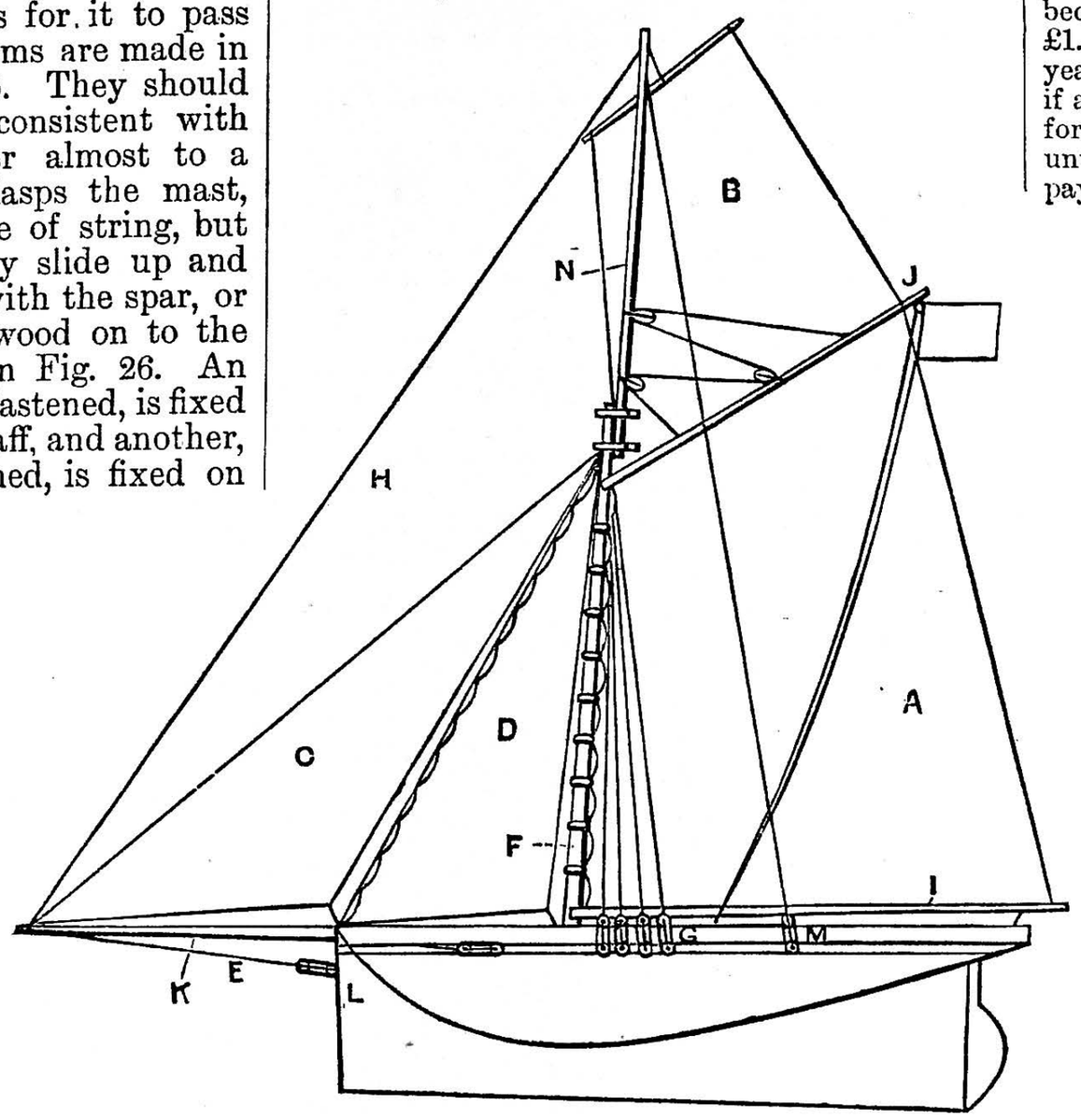
When the money is returnable under the scheme, the initial deposit of £2 10s. for a pension of £13 becomes £5, and instalments are raised from 10s. to £1. If death overtake the insurer within three years, the £5 deposit is paid to his widow or heirs; if after three years, then the widow gets 5s. a week for twenty-six weeks and 2s. a week for each child until it reaches the age of twelve. These weekly payments to each family must never exceed 12s. for the first twenty-six weeks and 8s. thereafter. When there is a widow and no children, she receives 5s. a week for twenty-six weeks, and such sum in addition as will together amount to the total of the husband's subscriptions with interest at 2½ per cent. In cases where there is neither widow nor children the heirs receive £5. The rate at which pensions may be increased under this heading is for each additional £1 deposit 5s. 4d. increase to pension, and for each additional 10s. to the annual instalment £3 6s. 8d. increase to pension.

In the case of insurers falling into arrears with their instalments, back contributions may be paid any time within two years with interest at 5 per cent. per annum. In the event of death, however, before an insurer, who has fallen into arrears and who has paid not fewer than three annual instalments, attains the age of sixty-five, his widow or representative shall receive 5s. a week for twenty-six weeks, and such sum besides as shall make up the total amount of his subscriptions without interest. Insurers who fall into arrears, and remain in arrears after paying three annual instalments, receive back on reaching the age of sixty-five the money paid in, but bearing no interest.

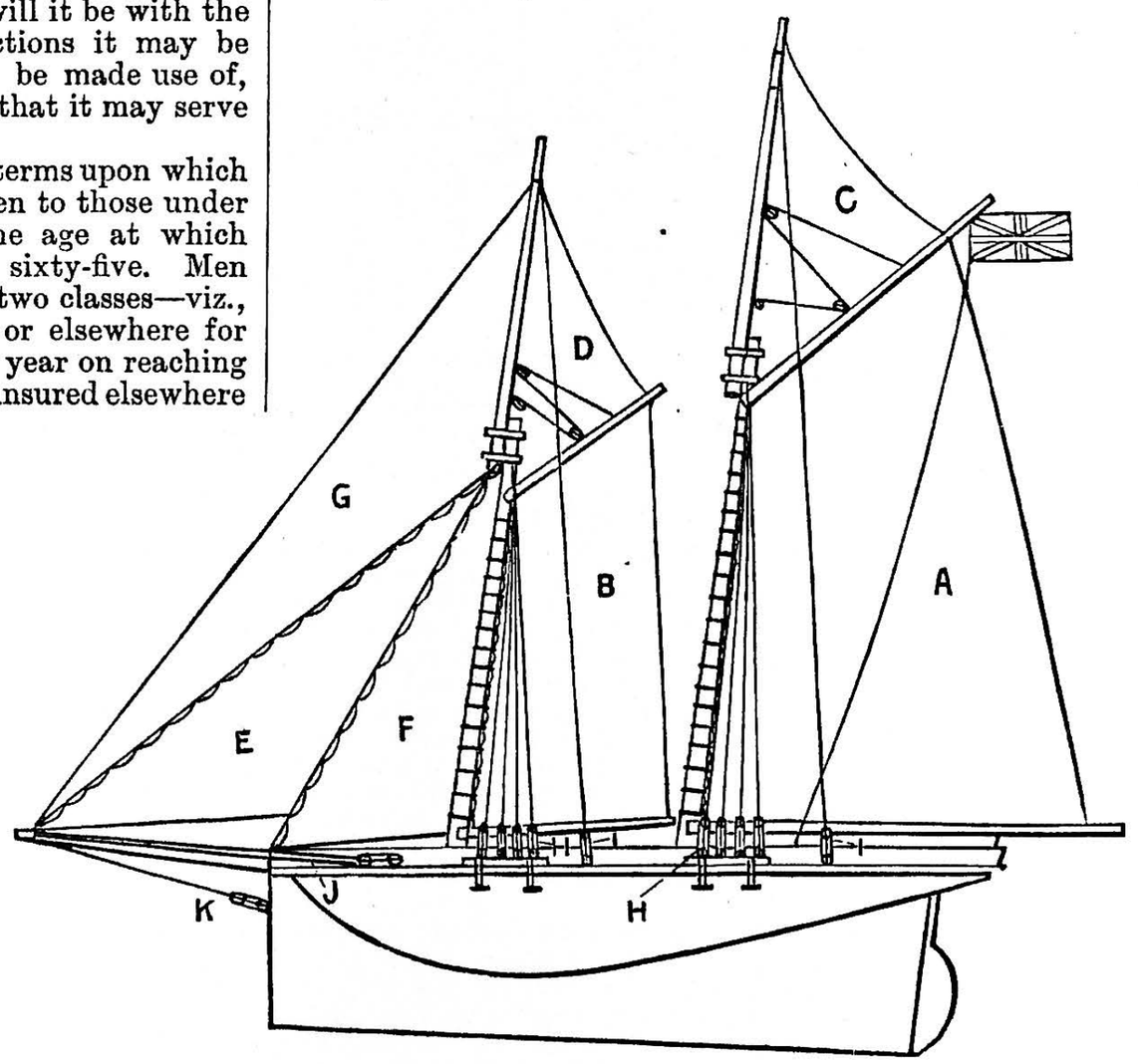
Omitting the provisions made for females, which are substantially the same, though for smaller amounts, we give the words of the scheme itself in regard to men over twenty five at the passing of the Act:—

"Every male who, at the passing of the Act, is above the age of twenty-five years, and who, within three years of the passing of the Act, being then under fifty years of age, shall deposit in the Post Office Savings Bank £4 if he is under thirty years of age, £5 if he is under thirty-five years of age, £6 if he is under forty years of age, £8 if he is under forty-five years of age, £10 if he is under fifty years of age, and shall prove that he is insured in the Post Office or elsewhere for a pension of not less than £6 10s. per annum, shall, on reaching sixty-five, and on showing that such pension will be paid to him, be entitled to an additional pension of £6 10s. per annum."

As we said at the beginning, we offer no criticism of the scheme. We simply set forth its leading features, knowing full well that each individual will apply it to his own case, and if he see benefits in it for him and his, he will, if the scheme becomes law, insure; if not, neither favourable nor unfavourable criticism will have any practical effect.



Model Boat-Making. Fig. 21.—Rigging of a Cutter—A, Mainsail; B, Topsail; C, Jib; D, Foresail; E, Bowsprit Stay; F, Mainmast; G, Mainstays; H, Forestay; I, Boom; J, Gaff; K, Bowsprit; L, Sidestay of Bowsprit; M, Backstays; N, Topmast.



Model Boat-Making. Fig. 22.—Rigging of a Schooner—A, B, Mainsails; C, D, Topsails; E, Jib; F, Foresail; G, Forestay; H, Mainstays; I, Backstays; J, K, Stays to Bowsprit.

NOTES FOR WORKERS.

IF a light be applied to petroleum, the latter is so inflammable that the flame spreads over the whole bulk as a flash. The results are sometimes disastrous, and great care is required in the carriage and use of such an inflammable substance.

EARLY this year two goods trains on the Transcaucasian Railway came in collision. They were laden with petroleum, which at once took fire; in a moment both trains were in flames from end to end, the employés not even having time to leave their vans, and therefore being burnt to death.

A PIN manufacturer in Ansonia (U.S.) is about to make use of some twenty barrels of imperfect pins in laying a sidewalk in front of his residence. There is in that town a small piece of sidewalk built of scraps from the pin factory which, by corrosion, had in a few years become so hard as to require much hard work in drilling, etc., to make a hole large enough to receive the lower end of a telegraph pole, although the layer was only 3 in. or 4 in. thick.

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TRADE: PRESENT AND FUTURE.

*** *Correspondence from Trade and Industrial Centres, and News from Factories, must reach the Editor not later than Tuesday morning.*

TIMBER TRADE.—The London dock deliveries again show an increase over the corresponding period last year. Now that the differences with the bricklayers have been settled, there is every prospect of recovering ground. Reports from West Hartlepool, Hull, and Grimsby show that there is an improving tendency. Our Liverpool correspondent writes :—Business has been rather more active during the last month, though there are no changes in value to report. Yellow and red pine and oak have been quiet. Elm has been in better request. Ash has been more inquired for. Of pitch pine 6,602 tons have arrived. Mahogany, 1,620 logs have arrived from St. Domingo, 425 from Honduras, 110 from Mexico, 366 from Africa, 72 from Colon, and 17 from Bombay. Cedar, 13 logs from Honduras, 6 from Mexico, 12 from Colon; 1,093 pencil cedar from Pensacola, and 7,971 pieces Californian redwood.

PAINT AND VARNISH TRADES.—Sierra Leone copal, 12 packages have sold at 9d. to 1s. 2¾d., according to quality, and 12 tons Brazilian copal at 45s. per cwt.

BOOT AND SHOE TRADE.—Trade is very brisk in Norwich, Nottingham, Kettering, and Desborough, not forgetting London, where the hand-sewn trade is also better than it has been for a very long time past. This class of trade is seeing a good season, though it may be short.

JEWELLERY TRADE.—London jewellery trade is better than it was, but the shopkeepers are complaining bitterly.

HATTERS' TRADE.—The strike in the hat trade at Stockport has been settled by the withdrawal of the *employés'* demands.

SILVER AND CUTLERY TRADES.—The Sheffield silver and electro-plated trades have fallen, and some cutlery works have been closed, so slack are the home and foreign markets.

IRON AND STEEL TRADES.—There is hope in the condition of the steel trade. Indian markets are opening well for spring steel and octagon sections, and the file industry is looking up. South American trade continues to increase in regard to cutlery and files. Mining tools are in good request, but there is no demand for shipbuilders' tools. Our Rochdale correspondent writes :—Trade is in a very unsatisfactory state, but may be better when the new blast furnaces start "blowing" at Castleton.

COAL TRADE.—With the restarting of the Durham pits, more gas and household coals are thrown on the market, with the result that buyers are able to bid down prices. Steam coals remain steady. Steam small continues to cheapen, the supply being fairly plentiful. Bunker coals are bidding for more orders. Coke is again put forward for shipments at steady values.

CYCLE TRADE.—Trade is still very brisk. The latest firm to commence cycle manufacture is the Salvation Army.

COTTON AND FLANNEL TRADES.—The cotton trade cannot be said to be satisfactory. The flannel trade is better.

CHEMICAL TRADE.—The chemical market retains steady prices. Crystal soda, bleaching powder, soda ash, and sulphur are, however, scarce.

ENGINEERING TRADE.—The general condition of the trade is still decidedly unsatisfactory. So far as can be ascertained, the tone of the pig iron trade is indicative of a hardening tendency. As to manufactured material, the reports from most of the finished iron centres are more hopeful. Business is still generally very slack in Manchester and district.

BUILDING TRADE.—Colne masons and wallers have resolved to give notice to the builders and contractors for an advance from 8d. to 8½d. per hour. Luton bricklayers and carpenters have struck. In Manchester and Salford trade is still steady and firm.

JOINERY TRADE.—The master joiners of Kirkcaldy recently agreed to grant the same increase in wages to their *employés* as the Edinburgh masters. The Edinburgh employers, however, have only given a farthing increase, and this the Kirkcaldy men have refused to accept, having been already some time on strike, especially as in Edinburgh the men have much higher wages than in Kirkcaldy. All the local joiners are expected to leave the town immediately, and a good proportion start work at Leith.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

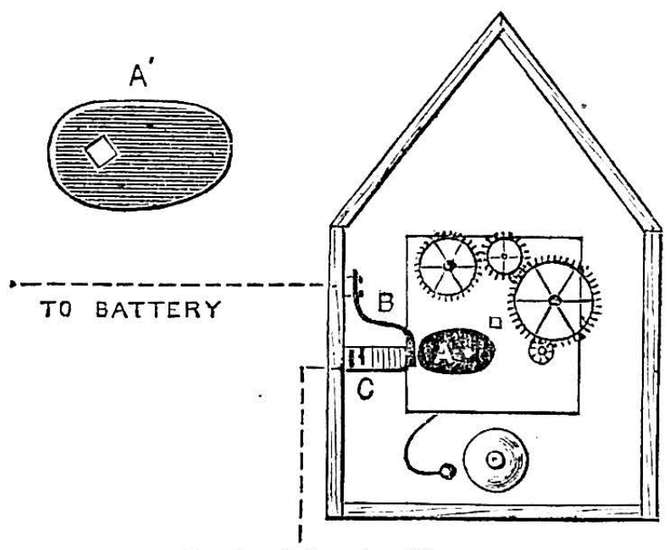
In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given.*

I.—LETTERS FROM CORRESPONDENTS.

Hobbyists' Emporium.—J. W. B. (*Huddersfield*) writes :—"I shall be pleased if an Amateur Co-operative Society could be formed with workers of WORK, etc., such as BONA FIDE speaks of in p. 156, No. 166. I keep a small ware and general shop, and would do my best to make ornamental stools and other goods, and exchange them with other correspondents."

Hypnotising Fowls.—G. P. (*Aberdeen*) writes :—"One who for many years has been an unsuccessful breeder of fowls has succeeded in making hens cluck artificially. The power employed is hypnotism, which was first tried on a morose hen by making thirty or forty hypnotic passes over her back. After six or seven passes the wings drooped, and next day the hen appeared in a dazed condition. She then took kindly to the chickens, and so successful was the treatment that chicks from other flocks left them, and watched for an opportunity to get under her wing."

Early Riser.—W. F. P. (*Chalk Farm*) writes :—"Seeing in WORK particulars of an 'Early Riser's Electric Clock,' I send you my arrangement, which I think has an advantage over the one sent by CAWD HUD (see No. 160, page 61). The bell, switch, clock, and battery can be arranged on a similar board (but I prefer to put the battery out of sight), the only difference being in the clock. I got used to the ordinary alarum, and so have devised this plan. I have an ordinary alarm clock in a wooden case, and on the winding square—*i.e.*, the square where the key fits on—I have secured a cam, which is fastened by having a square hole in it, and have so placed it that when the alarm has finished ringing, this cam presses a brass spring on to a terminal, and so forms the circuit. See Figure at A.



Early Riser's Alarm.

The diagram shows the clock with the dial off. A is the cam, B is the spring, C the terminal, from which runs a wire to the bell; and the wire from B goes to the battery. In CAWD HUD'S arrangement the bell ceases to ring when the alarm is run down, whilst mine continues to ring until switched off, which means a thorough wake-up if placed some distance from the sleeper, as several of my shopmates have placed theirs. I have had mine a similar length of time (three years), and it has always answered very satisfactorily; and where the ordinary alarum ceases to ring mine continues, and so I think this is a decided gain. The cost might be a trifle more, but not much, and I think it amply pays for itself."

Hobbyists' Emporiums.—TAYLOR & CO. (*Blackpool*) write :—"With reference to your leaderette upon this subject in WORK, No. 160, we shall be pleased to receive any article in fretwork or carving from readers of WORK for disposal at our *depôt* during the months of June to September, inclusive. We have a large stand in the Royal Palace, where we offer for sale work done by our *employés;* and we have as many as 20,000 visitors in one day." [Taylor & Co. should advertise their terms in WORK.—ED.]

Hobbyists' Emporiums.—B. A. B. (*Hampstead*) writes :—"I will, if agreeable to your readers, expose their productions for sale in a good shop in Hampstead, near station and tramcar terminus, where there is much traffic. Terms shall be mutual."—[We give publicity to this suggestion, as B. A. B. is an old subscriber, but his address and all matters of this business nature must go through the "Sale and Exchange" column.—ED.]

Copying Ink.—G. H. K. (*Bond Street, W.*) writes :—"The formula below is an improvement which I tried the other day, and a good one for copying ink : 1 oz. ordinary ink evaporated down to a quarter of its bulk, and 20 grs. of powdered sugar added and dissolved."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Dressing Albatross Skin.—G. J. S. (*Arundel*).—If the skin is stiff from having been so long rolled up, it must be softened by wrapping in damp cloths. I should then advise you to stretch it, feathers downwards, and carefully to remove any flesh, fat, etc., that may have been left adhering to it with a knife. Of the extreme oiliness of the skin you may get rid by rubbing it with powdered whiting, which can be removed by scraping, and doing this as many times over as may be found necessary. The skin being what it is, you may perhaps find it desirable to dust in whiting on the feather side also, and afterwards to beat it out. The dirty feathers you can clean by carefully sponging with warm and very strong soapsuds, a very little only being used. This will not injure the feathers if you dry them with clean white sand used warm. This you will sprinkle on the wet part, and beat it out with the hand, striking only in the direction in which the feathers grow. Bird-preservers finish drying with powdered starch to bring up the bloom of the feathers; but, perhaps, with your large skin this may be unnecessary. Before sewing it on the cloth, you should dress the inner side with the arsenical soap used by bird-stuffers (and which may be bought at their shops, or often at those of chemists), or with some other of the preservative compositions in use. This is to be done as a protection against insects.—M. M.

Silk and Cotton.—DROPSALIA.—Messrs. F. & E. Stanton, Silk Mills, Lewisham, S.E., are prepared to supply you with soft unspun silk in any quantity, and will wind it on any kind of reels or bobbins you may require for your purpose. They do not supply soft cotton. This may be obtained from makers of sewing cotton.—G. E. B.

Balance Wheel for Watch.—S. M. H. (*Bootle*).—If you will apply to Morris Cohen, 132, Kirkgate, Leeds, who advertises in WORK, he will probably be able to supply you with a balance wheel for a Geneva watch.—G. E. B.

Battery of Gas-lighter.—S. M. H. (*Bootle*).—If the gas-lighter is worked by a battery, it is most likely to be a chloride of silver battery furnished with zinc and silver plates separated by folds of blotting-paper. To repair this battery, take out the plates and soak them in hot water for an hour; then take off all the blotting-paper, and well wash the plates. Coat the silver plate with chloride of silver paste, and envelop the zinc plate with blotting-paper dipped in a strong solution of chloride of zinc. Replace all in their cells, clean connections, and connect up as before.—G. E. B.

Electric Alarum.—J. H. C. (*Halifax*).—The alarum may be worked as you suggest. J. H. C. uses the spring of an ordinary alarum clock to close the circuit of an electric bell. As the spring unrolls and expands it comes in contact with a pin, and closes the circuit.—G. E. B.

Hot-Air Engine.—APPRENTICE.—The model engine of this kind, shown in No. 149, page 717, can only be considered as a toy, therefore it is not expected that it should be provided with those arrangements which would be needed in a real engine applied to practical use. From the rough sketch given, we cannot supply the details our correspondent asks for, though the action is plain enough to a practical mechanic. There is no doubt an engine of a useful size might be constructed on this plan, but we fear that it would give but little available power in proportion to its size. If such a one is ever made, we shall be pleased to receive particulars and results obtained. In regard to the fan blower, as per sketch sent, we remember the *identical* thing being brought out—we fancy under a high-sounding Greek name—some forty-eight to fifty years ago, and we have had many a grind with it in freshening up a half-dead parlour fire. There is no patent right in existence now which could interfere with our correspondent.—C. E.

Soap Tray.—H. M. (*Ashfield*).—We have examined the rough model and sketch sent us, and have no doubt it will do all our correspondent expects. We do not think, however, it would be considered in the Law Courts either to have *sufficient invention* in it or to be the *subject matter* of a patent, not being, in the legal sense of the term, a "new manufacture." It is clearly a fit and legitimate subject for registration as a *design*. We have also an idea that it would not hold good under what the law pleases to term an "analogous use," and we fancy we have met with the equivalent of the plan applied to an *analogous use* some five-and-twenty years ago. At any rate, if H. M. likes to take risk, and has not to appear in the Law Courts to maintain his rights, he may make something out of it.—C. E.

Refining Gold and Silver.—H. B. W. (*Cairo*).—I do not know of any easy method for refining gold and silver. If the alloy contains one-third part or less of gold, the latter metal may be separated by boiling the alloy in nitric acid diluted with half its bulk of water. The resulting brown powder must be well washed, dried, and fused with borax in a fire-clay crucible. The silver is thrown down as silver chloride by adding common salt to the acid solution employed in dissolving the gold silver alloy.—G. E. B.

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Oak.—MOUNTAIN ASH.—You can obtain oak at any hardwood timber merchant's in Cardiff. The price would be from 4d. to 5d. for plain figured wood, and about 10d. for wainscot in the foot super. of 1 in. Your width of 18 in. to 20 in. is excessive, and you will find it difficult to obtain; so you had better get 9 in. or 10 in. and join it. Hungarian—*i.e.*, Trieste—oak is Austrian wood, and Odessa is Russian. The term "Crown" signifies best quality, and of the two ports that which comes from Odessa is the better, and if you get some good, well-figured wood, you would find it equal to British for cabinet work.—A. J. H.

Batteries.—W. E. L. (*Kimberley Road*).—There is a paper at present in hand as to how to make batteries in the easiest and simplest way, which will doubtless appear in due course. If you will look up the index to Vol. II. of WORK, you will there find a whole series of papers by Mr. G. E. Bonney, in which he treats in a most able manner the subject of small electric lights. If you would like to order the numbers separately, they are Vol. II. of WORK, Nos. 76, 82, 89, 92, 94, 97, 99, 101, and 104.—J. B.

Revolving Stereoscope.—STEREO.—The accompanying diagrams represent a pillar stereoscope which will be capable of holding a hundred or more slides. This instrument takes the form of an upright wooden box or pedestal, which may be a foot square, and of a suitable height to bring the lenses on a level with the eye, but these dimensions can be varied considerably according to requirements. Fig. 2 shows more clearly the interior arrangement, from which it will be seen that the series of pictures are mounted on an endless band of tape, attached to a long horizontal shaft, disposed within the pedestal in such a manner that the pictures are successively brought into position in front of the lenses. A (Fig. 2) is a kind of box or drawer, which is open at the back end, and made to slide in and out of the upper chamber of the

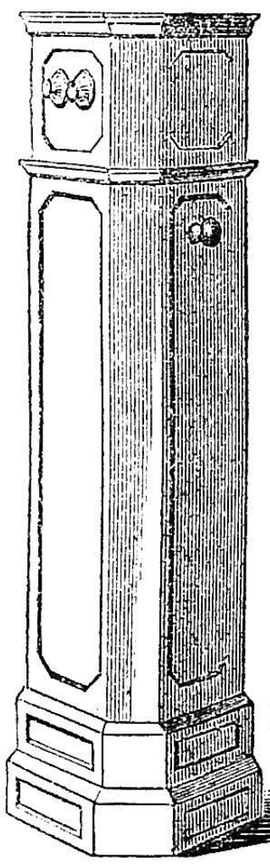

Fig. 1.

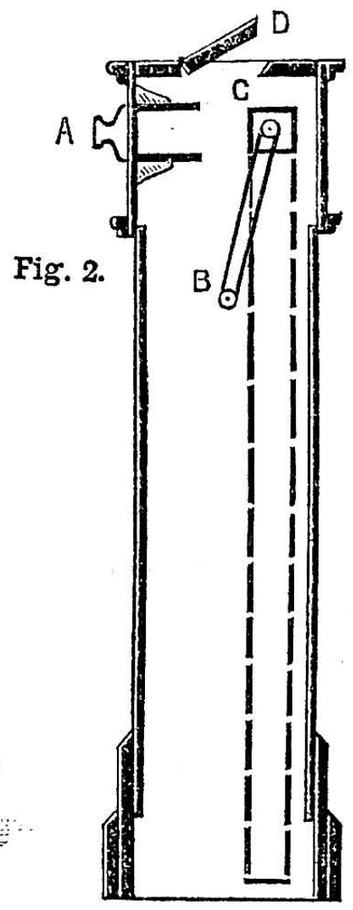

Fig. 2.

Revolving Stereoscope. Fig. 1.—Exterior Appearance of Stereoscope. Fig. 2.—Interior of Stereoscope, showing internal Arrangement—A, Slide or Drawer carrying Lenses; B, Adjusting Wheel; C, Revolving Drum; D, Adjustable Mirror.

instrument for the adjustment of focus. The wedge-shaped lenses are attached to the front end of the drawer, with the thin edges together, and the centre is divided longitudinally by means of a wood or metal partition. B is a small knob attached to a wooden grooved wheel, which serves to revolve the drum (C) by the aid of a strap stretched between the two. D is a small lid, furnished with an adjustable support and a mirror, by means of which the light may be reflected down on to the face of the drum. The views are stitched together or fastened to a length of tape, the top of one to the bottom of the next, and in this manner they are placed over the top of the drum. It will thus be seen that the simple turning of the knob (B) causes the views to come up one after the other in front of the lenses.—C. A. P.

Gelatine Graphs.—J. W. (*Chorley*).—Read "Graphs, and How to Make Them," in WORK, No. 162.

Receipts.—J. G. K. (*Watford*).—Some day your kind suggestion may be carried out by Messrs. Cassell & Co., Limited.

Stopping-off Varnish.—H. B. W. (*Cairo*).—Copal varnish, tinted with an aniline spirit dye, will make a good stopping-off varnish. If intended to be used in a hot gilding bath, the varnish must be allowed to get quite hard in a warm dry place, free from dust, before placing it in the bath. I know of no varnish that will stand the attacks of a hot cyanide solution, as the best soften if exposed long to the action of the bath. Adding a little fine rouge to the copal varnish will aid it in drying quickly and setting hard. The varnish may be dissolved in warm spirits of wine.—G. E. B.

Litho Transposition.—F. J. B. (*Chester*).—I have already given a full description of transposition, or reverse transferring, of lithography in my answer in "Shop" to T. A. J., on page 509, No. 136, Vol. III. of WORK; but as you are a new subscriber, perhaps the Editor will kindly allow me to repeat one of the methods which is to protect the drawing or lettering on the stone with resin, and etch it until the letters are raised from the level of the stone to a degree perceptible to the eye. Then wash the stone, first with turpentine to remove the ink, then with clean water, after which paint the stone solid all over with litho ink. When dry, it may be rolled up in the ordinary way in printing ink. The letters being now raised, it is necessary to level them to the stone with snake-stone, and the stone can be easily gummed, rolled up, and printed, the letters standing out white on a black ground. Should any accident occur to the groundwork in using the snake-stone, it can be easily filled in and remedied with litho ink.—A. J. A.

Threefold Screen.—SCREEN.—If you look through the various indexes (price 1d. for each volume), you will find much dealing with screens. Some time back I gave in "Shop" a small threefold screen; and in another part of "Shop" I speak concerning a peculiar form of joint. Repetitions are, of course, out of all reason; and were not the space required for many other matters at present, I should have been glad to have added something fresh to my previous information. It is our aim to give satisfaction; and if after you have searched the indexes you still remain as you are now—unsatisfied—write again, and perhaps one of our staff may prepare a "Screen" paper for the body of WORK. The matter of cost is one which is best decided by simple calculations, and a visit to the woodyard on inquiry.—J. S.

Enamel Bricks.—J. M. (*Leith*).—Enamelled bricks are generally made from fine clay, although at some works the ordinary red bricks are enamelled. They are moulded and dried in the usual way, and baked in a kiln into what is called biscuit; when cool, they are wetted, and the enamel, in a liquid state, is laid on from a sieve, and the brick re-burnt to set the glaze. The enamel is composed of calcined flints and lead ashes pounded fine, and mixed to a paste. For colouring, oxides of iron and manganese are used for black and brown, copper slag for green, smalt for blue, etc. The composition of the enamel is found by experience, and varies according to circumstances, each maker having his own special mixture.—M.

Capacity of Pump.—WALSALL.—To find the number of gallons discharged per stroke, multiply the square of the diameter in inches by the length of stroke in feet, and divide the product by 30. For example: let the diameter of bucket or plunger, as the case may be, be 20 in., and the stroke 4 ft., then the number of gallons lifted at each effective stroke will be:— $\frac{20 \times 20 \times 4}{30} = 53\frac{1}{3}$ gallons. In a given time a double-acting piston-pump will lift twice as much water as a plunger-pump working at the same speed and of the same size, consuming, of course, twice the power.—F. C.

Tan Cow-hide.—A. B. (*Oban*).—To give you a full description of all the processes in the tanning of a hide would be impossible in the "Shop" columns, but I will deal with your question sufficiently to enable you to grasp the idea of what is meant, and what a vast field the word "tanning" embraces. I have supposed you to mean by "boot-making," sole leather. The theory of tanning is shortly this:—After the impurities of the skin are removed, it is steeped in an infusion of oak bark, which consists of two distinct substances: viz., the gallic acid (gallic acid is soluble in ten parts of cold water, and also in three parts of boiling water) and the tanning principle. The gallic acid deprives the skin of its oxygen in a gradual manner, and while this is going on the tan combines with the fibrous part, and forms leather. During this process, which is slow and gradual, the skin is found to have increased in weight, and to have acquired a considerable tenacity and impermeability. But before the hide is ready to receive the above two substances, or before it is unhaired (your first question), it is preliminarily prepared. If it is a fresh hide, it will have to be soaked, to develop it to its greatest possible dimensions. A hide that is dry, and has so become hard, should be soaked in the liquors that have soaked softer hides. These are called "old soaks," and are found to contain more softening properties than can be found in clear water. The hide is now unhaired; this is done with lime. It is a process that has never been supplanted by any modern invention. The lime swells the cells of the hair in epidermis (or grain, as it is called when it becomes leather), softens the glutinous portions of the skin ready to receive the tanning agent, and dissolves a substance (the nutrient of the hair) that hovers round the roots of hair. This loosens the hair, which is then scraped off with a blunt knife, which takes other surplus matter with it. The liming is done by laying the hide flat in a pit that has in it sufficient milk of lime to well cover it; each day it is taken from the pit, and the liquor is well stirred, to redistribute the lime, and again make it of an even consistency. After it has gone through this process, it is cleansed through clean water, etc. The liquor is prepared, and the butt suspended by the shoulders, and the time it is there it is kept in motion. Now, this is the first, and is called the "suspender liquor." The skin then, in due course, passes to the "handlers," and is laid flat in liquors that are frequently varied. The length of time it should remain in the various liquors depends not only upon what tanning agent is used, but also on what is to be produced, as the art of tanning consists in impregnating the animal matter with that peculiar principle, taken from the vegetable kingdom, called tan, or tannin. It has next to pass to the "bloomers," through clear liquor, then drain; go through the striking process, and when smoothed by this means it is ready for the finishing touches, which are according to what market they are for. Two of the best books I should say you could get would be, "Text-Book of Tanning," by H. R. Proctor, F.C.S. (1885), and "The Art of Leather Manufacture," by Alexander Watt (1885).—W. G.

Boot-Lace Tagging Machine.—F. B. (*Leek*).—I have kept your letter unanswered longer than I should have done, as I really could not see, according to your diagram, what was the matter with your machine; but now I am in the position to tell the cause of your tags flattening, and also, what will obviate it. Fig. 1 is a reproduction of your diagram. The dotted line at A is to represent a lace tag. Well, the fact is, that when you filed the dies up you made the two circular portions, B and C, too large, and perhaps not quite smooth enough; therefore, I advise you to see to these two particulars. You ask if there are any other kinds of dies.

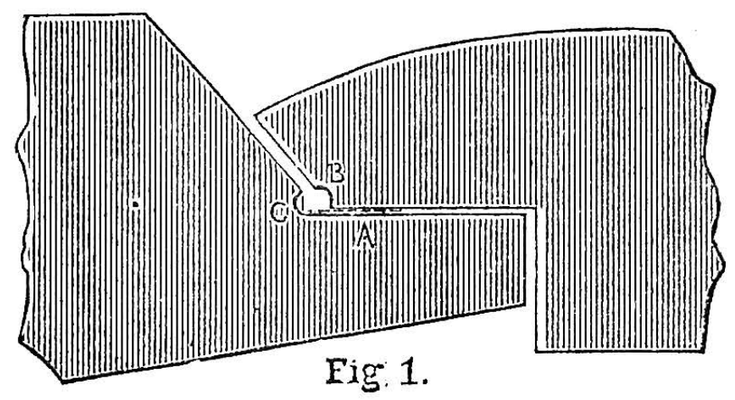

Fig. 1.

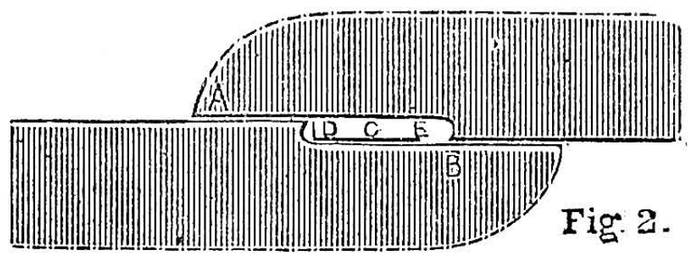

Fig. 2.

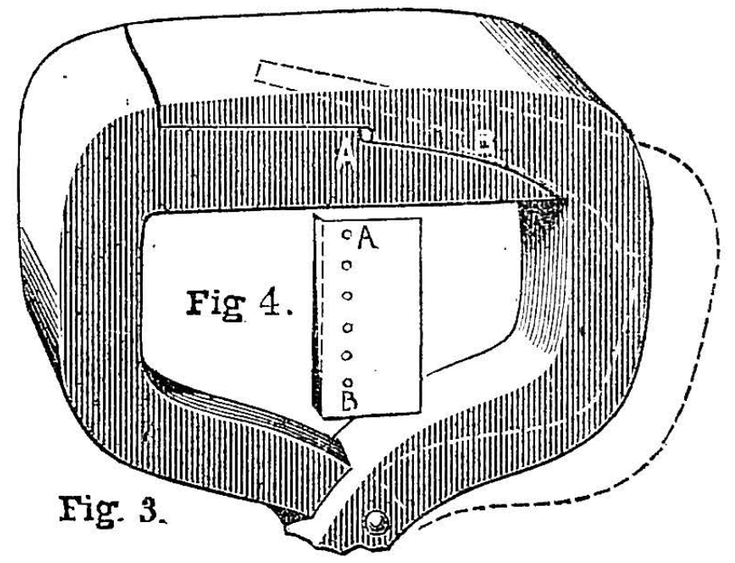

Fig. 4.

Fig. 3.

Boot-Lace Tagging Machine. Fig. 1.—Dies too large for a Tag. Fig. 2.—Dies with Parallel Jaws, showing position of Tag. Fig. 3.—Head of Lace-Tagging Pliers. Fig. 4.—Lace Tag.

Well, Fig. 2 is one. It is similar to your own, only that the top, A, is like the bottom, B; and you will soon see the advantage of this, for as C is the tag, and the lace is placed on to it at D, and pulled at each end, and the dies pressed together, it pushes the tag at E, which rises it in a circular form (the die being that shape), and then (unlike your own) it strikes the top die at D, and each portion of it does the same as the tag rolls round and grips the end of the lace. If you find they are not quite round, keep twisting the tag round and round, at the same time shifting the dies backward and forward, and this, you will find, will greatly improve them. But any dies, when they are closed, should have an aperture no larger than the tag is wanted to be when finished. Fig. 3 is another kind of die; these are in the form of pliers, and are very good generally. The dotted line in this diagram shows that at B, when being closed, they will just catch the end of the tag. Fig. 4 is about two-thirds the size of the tag of the lace, which is a very thin piece of sheet brass, with about six holes punctured in it from A to B, with the rough edges inside to grip the lace.—W. G.

Electric Bell.—MANEO.—You can work a bell by attaching the hammer to the contact breaker of an induction coil, but it would be far better to work it with a simple electro-magnet. The current from your induction coil is no use to excite a magnet to work a bell.—F. C.

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S. N. Telegraph Coils.—G. H. (*Sheffield*).—The needle and coils of a S. N. telegraph instrument are precisely the same as that of a galvanometer. A paper on this subject is in the Editor's hands, awaiting publication. Wind each coil with 3 oz. of No. 36 or 2 oz. of No. 38 silk-covered copper wire.—G. E. B.

Six-o'clock Men.—ENGINEER.—Replying to your query, one frequently sees advertisements in the engineering papers for managers, in which, after specifying the qualifications wanted, there is the laconic addition, "Six-o'clock man." Managers advertising for situations will sometimes make use of the same expression. It is only of late years that this peculiarity has become noticeable, and there is good reason for it. There are two classes of men in engineering works—the six-o'clock men and the after-breakfast or office men. The practical work of the factory is done by those who begin work at six o'clock in the morning, the work of the office by those who begin at nine or half-past. Few men like to begin work at six. Many entrusted with the work of supervision who have been supposed to begin at six in the morning with the men, but who, because of their superior position, have not been booked in with the men, have gradually become lax, and their first appearance on the works has approximated more nearly to nine than to six. This has frequently become a sore point, and has caused much friction between employers and their responsible servants, especially when—as has been the case with some firms in recent years—the employers have resorted to the practice of checking the time of their foremen and managers. However, it is certain that, whether popular or unpopular, there is a strong sentiment among employers growing up in favour of six-o'clock men. So that, other qualifications being equal, a manager or foreman who can be trusted to be at his post at six o'clock prompt will invariably stand a better chance of securing a good position than a man who cannot rise early. Of course, this presupposes good physical health; for the lack of this no amount of mere technical education will compensate. Not many years ago the masters of the old school were for the most part in their workshops between six and seven o'clock in the morning. The practice is not so common among their successors, who were born with the proverbial silver spoon in their mouths; and this is one reason—perhaps the chief one—why they are disposed to insist on early rising on the part of those to whom they delegate the supervision of the works.—J.

Horse-Shoeing.—FARRIER.—The foot should have only so much horn removed from it at each shoeing as is necessary for the proper fitting of the shoe, and no more. The frog should take a bearing on the ground, but no other part of the hoof should be weakened to give this healthy action. Shoes cannot be too light if they give sufficient wear. The width of a shoe need be no more than is necessary to cover the bearing surface. Nails are the most secure and simple fastening for horse-shoes, and a properly driven nail never does any harm. The most important requisite in horse-shoeing is the adoption of a correct system, not the use of any special form of shoe. All shoes should have a level bearing on the foot, extending from the toe to the heel. The ground surface of a shoe should follow the form of the ground surface of an unshod foot which has travelled on a level road. No better form of shoe exists than a narrow one made rather thicker at the quarters than at the heel and toe. The recent proposal to affix shoes on feet (without nails) by broad projections into the hoof, and by pressure round the wall, is impracticable and injurious. No advantage follows the retention of shoes on a foot for more than four weeks, as the growth of the horn in that time produces a disproportionate hoof. If in this time a shoe is not worn out, it should be removed.—A.

Fixing Glass to Honey Boxes.—W. S. (*Inverness*).—Gummed paper could scarcely be strong enough for your purpose. I should prefer to use Le Page's liquid glue, or the patent fluid water-resisting glue of the Waterproof Glue Co., 62, Dale Street, Liverpool, who claim for their cement the power of holding well to glass; 4d. or 6d will put W. S. in possession of a bottle of the first, or a tin of the second.—S. W.

Tailors' Cutting and Fitting.—SHEARS.—These articles are being arranged.

Mahogany Mouldings.—G. B. (*Accrington*) will have some difficulty in getting a small quantity of mahogany mouldings, as very few mills keep this in stock. He does not state whether he wants any special pattern or one of the regular stock patterns. As it is only a small quantity he requires, he had better get it out himself, or ask one in the trade to do it for him.—A. J. H.

Amber-Tipped Paper.—F. A. (*Leicester*).—To give an amber-tipped quality to cigarette papers, many manufacturers use pure white ozokerite. This treatment is not very objectionable to the smoker, as ozokerite is insoluble in water. If the amber-tipped portion of the paper, however, is allowed to burn, its highly inflammable nature is very noteworthy. It is no uncommon thing to use paraffin. A composition introduced to give an amber-tipped quality to cigarette papers is three ounces of shellac dissolved in a gill of spirits of wine or methylated spirit, and the consistency of thickness may be regulated by adding more or less shellac, as found desirable. Another method is the following: 48 parts by weight of shellac (to be melted at a gentle heat), 12 parts of Venice turpentine, and 1 part of balsam of Peru. Incorporate the ingredients together with one addition of, say, about 36 parts of the best vermilion, or an equivalent proportion of other suitable colouring matter.—F. G.

III.—QUESTIONS SUBMITTED TO READERS.

*** *The attention and co-operation of readers of* WORK *are invited for this section of "Shop."*

Carving.—C. M. S. (*Aldington*) writes:—"Can any correspondent tell me how to clean carving in white wood which has got dirty during the process? It does not do to use water, which raises the grain."

Loco. Work.—CORKSCREW writes:—"Will any reader of WORK kindly describe, with sketch, a ringing punch? It is used in loco. work about and behind the smoke-box end. Please state its object and use."

Wood Filling.—A. P. M. A. (*Streatham*) writes:—"Could any reader tell me of some putty or cement for filling cracks in wood, as I find the putty cracks and falls off?"

Ambulance Station.—ST. JOHN writes:—"Will some reader kindly give me a design for ambulance station and head-quarters, also superintendent's house? The head-quarters and station are intended for a corps consisting of fifty members. They must comprise lecture-room, to accommodate an audience of one hundred persons, ambulance-room, small committee-room, ambulance instruction room, to accommodate thirty pupils, library, cloak-room, w. c., and extra room. The superintendent's house must have kitchen, sitting-room, two bed-rooms, bath-room, and w. c."

Pitch.—J. J. (*Barrow-in-Furness*) writes:—"I should be glad if some kind reader could give me the recipe for making the pitch used by repoussé workers."

Gun Models.—ANXIOUS GUNNER writes:—"At the Naval Exhibition last year at London, I saw two guns which visitors were firing from at some moving ships in Armstrong and Mitchell's shed. I should like to make a model of the largest gun. Could any kind reader give me the sizes, or information as to where I could get any paper or book with them in?"

Wood.—WALNUT asks for an address where American walnut, suitable for making furniture, can be obtained.

Oleographs.—WALNUT writes:—"Will any reader tell me where oleographs of the Ramsgate lifeboat (the *Bradford*) could be obtained?"

Guitar.—A. T. (*Bollington*) writes:—"Will J. G. W., or any other kind person, give me the rough outlines of a guitar, the stringing of the same, the dimensions, etc.; and also please say whether it can be made best in a mould, as recommended for the zither?"

Refreshment-Room Sideboard.—A. B. D. (*South Shields*) writes:—"Can any reader of WORK oblige me with a good design for a sideboard for refreshment room; either in pitch-pine or to stain and varnish would do—about 8 ft. high, and about 10 or 12 ft. long? Also some idea of cost of same."

Soft Soap.—D. A. L. (*Bacup*) writes:—"Will any reader kindly inform me, through WORK, how to make common soft soap for cleaning purposes?"

Hoop Staves.—HOOPMAKER writes:—"Will any reader kindly inform me where *cast steel hoop* staves are *manufactured*, as used by hoopmakers?"

Fretwork Market.—W. P. (*Dartford*).—Advertise your articles, with prices, in WORK.

Towel-Horse Rails.—ANXIOUS writes:—"Will someone kindly tell me how hardwood towel-horse rails are most easily and quickly turned—some quick and cheap method?"

Cricket Bats.—L. M. (*Roscrea*) writes:—"I should be very glad of any information about making cricket bats, kind of wood, method of splicing, and where the materials can be obtained."—[A comprehensive article upon this subject would also be entertained.—ED.]

Sash Beads.—H. F. (*Ramsbury*) writes:—"Can anyone give me rules for cutting beads round pivot sash to enable same to work properly, but still to fit close when sash is closed? At present I have to keep cutting each joint until satisfactory results are obtained."

IV.—QUESTION ANSWERED BY A CORRESPONDENT.

Pinhole Photography.—ST. MUNGO writes, in reply to H. A. H. (*Tunbridge*) (see No. 164, page 126):—"Any camera will do, provided it is light-tight. The exposure is longer than with a lens. With an aperture of $\frac{1}{80}$ of an inch the exposure should be 5, 7, 10, 13, 16, 20 seconds at 2, $2\frac{3}{8}$, $2\frac{3}{4}$, $3\frac{1}{8}$, $3\frac{1}{2}$, and 4 in. focal distance respectively; but the best result will be got when the pinhole is about $\frac{1}{300}$ of the focal distance. No image is seen on the screen, and the shorter the focal distance the wider the angle of view."

V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—F. S. (*Exeter*); H. O. (*Thurso*); T. D. (*Newcastle-on-Tyne*); F. C. B. (*Glasgow*); NATURALIST; G. H. S. (*Stockton*); AMATEUR; W. R. (*Sturminster-Newton*); F. S. (*Old Swindon*); T. W. S. (*Hyde*); J. E. (*Aberdeenshire*); D. R. (*Dennistown*); NOVICE; M. E. F. (*Stockton-on-Tees*); W. C. (*Rawdon*); THE UNIVERSAL AMATEUR; W. S. (*Applebu*); T. P. (*Bristol*); F. J. K. (*Tufnell Park*); D. J. G. (*Holyhead*); W. E. W. (*Wimbledon*); S. R. (*Walworth*).

"WORK" PRIZE COMPETITIONS.

A general subject has been considered best with which to commence; and as most of the readers of WORK and thousands of the outside public know something of bicycles and tricycles, competition is invited for the best essay upon

"The Cycle: Its Worth to the Nation."

For the three best essays the following prizes will be awarded—

First Prize, £3;
Second Prize, £2;
Third Prize, £1.

ALL Essays to bear the WORK Prize Coupon, cut from one of the numbers of WORK in which the prize scheme is announced.

Each Essay to be signed with an original *nom de plume*, and to have the writer's real name and address securely attached to the manuscript in a sealed envelope.

No Essay to exceed more than two pages of WORK in extent, including any diagrams that may be necessary to elucidate the text.

In the work of judging regard will be had to original suggestions of value affecting the improvement of bicycles and tricycles, especially where such improvements are shown by diagrams.

All Prize Essays and Drawings to be published, if desired by the Editor, in WORK, but the copyright thereof to remain with the authors.

Copies of MSS. and Drawings to be retained by the competitors, as in no case can the return of MSS. be undertaken.

The Editor of WORK will supervise the judging of the Essays, and the selection as determined upon is to be final.

All manuscripts intended for the Cycle Essay Competition must be addressed to the Editor of WORK, c/o Cassell & Co., Ld., Ludgate Hill, London, E.C. They must reach him not later than Saturday, June 25, endorsed, "WORK Cycle Essay Competition."

NOTICE TO READERS.

Next Week's issue (*No.* 172) *will contain the announcement of the* SECOND "WORK" PRIZE COMPETITION *subject; also, among others, the following important papers:* HOW TO MAKE A CHEAP ICE CHEST; IDEAS IN GREENHOUSE BLINDS; HOW TO COPY GLASS POSITIVES; THE WAY TO MAKE CHEAP BLOWPIPES.

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"Screws and Screw Making."—The best book on the subject, 3s.; soiled copies, 2s. The Buyer's Guide to the best Books on Mechanical Subjects, with table of contents, price 6d.; in cloth, 1s. 6d.—Published by BRITANNIA Co., Engineers, Colchester. [21 R

Wanted.—To Manufacture or Repair for Trade or Amateurs any description of mechanical work. Models for Patentees executed from drawings. Terms moderate.—J. SUMMERS, 17, Regent's Row, Dalston, N.E. [22 R

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